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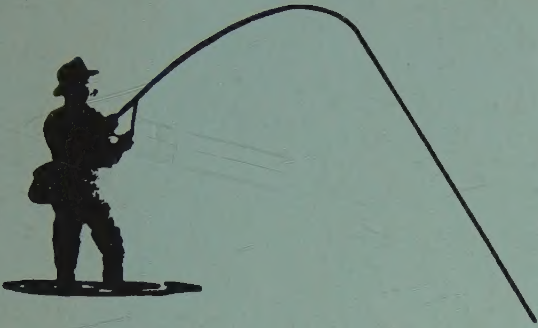

# SPORT FISHERY ABSTRACTS

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U. S. FISH AND WILDLIFE SERVICE

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# SPORT FISHERY ABSTRACTS

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*Sport Fishery Abstracts* is intended to furnish fishery biologists with abstracts of current literature in sport fishery research and management.

One volume, consisting of four numbers, is issued each year. Each number contains separate Author, Geographic, and Taxonomic indexes, and the final number of each volume contains cumulative Author, Geographic, Taxonomic, and Subject indexes, and a list of publications screened. Authors who publish in journals not screened for *Sport Fishery Abstracts*, and who would like their publications included, should submit abstracts to the Editor.

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# SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

Volume 29(4) 1984

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## AQUATIC PLANTS AND THEIR CONTROL

84-002729 Keast, A. THE INTRODUCED AQUATIC MACROPHYTE, *MYRIOPHYLLUM SPICATUM*, AS HABITAT FOR FISH AND THEIR INVERTEBRATE PREY. *Can. J. Zool.* 62(7):1289-1303. July 1984. In English with French summ. SFA 29(4)
[Dep. Biol., Queen's Univ., Kingston, ON K7L 3N6, Canada]

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84-002731 Fletcher, D. J. THE PHYSIOLOGICAL CONTROL OF APPETITE IN FISH. *Comp. Biochem. Physiol. A Comp. Physiol.* 78(4):617-628. 1984. SFA 29(4)
[Mar. Sci. Lab., Menai Bridge, Gwynedd LL59 5EH, Wales]

84-002732 Keese, C. W. WATER WELLS. *Proc. Fish Farm. Conf. Annu. Conv. Fish Farm. Tex.* 1984:65-73. 1984. SFA 29(4)
[Dep. Eng., Tex. A & M Univ., College Station 77843]

84-002733 Lester, L. J. AQUACULTURE GENETICS: GENETIC IMPROVEMENT PLANS FOR THE NON-PROFESSIONAL. *Proc. Fish Farm. Conf. Annu. Conv. Fish Farm. Tex.* 1984:33-43. 1984. SFA 29(4)
[Prog. Biol. Sci., Univ. Houston, Clear Lake, Houston, TX 77058]

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[U.S. FWS, Southeast. Fish Cult. Lab., Marion, AL 36756]

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[U.S. FWS, Southeast. Fish Cult. Lab., Marion, AL]

84-002736 Pollock, B. ~~R.~~ and R. H. Quinn. THE POTENTIAL OF AQUACULTURE IN QUEENSLAND. *Queensl. Dep. Prim. Ind. Conf. Workshop Ser.* QC83012 218p. 1984. A collection of papers--RS. SFA 29(4)
[Fish. Res. Br., Queensl. Dep. Prim. Ind., Brisbane, Qld., Australia]

## TROUT AND SALMON CULTURE

84-002737 Badino, G. and E. Lodi. ALLEVAMENTO DELLE LARVE DEL COREGONE (*COREGONUS* SP.; OSTEICHTHYES, COREGONIDAE) DEL LAGO DI VIVERONE. [REARING WHITEFISH (*COREGONUS* SP.: OSTEICHTHYES, COREGONIDAE) LARVAE FROM VIVERONE LAKE (NORTHERN ITALY).] *Riv. Ital. Pisic. Ittiop.* 19(2):55-61. Apr.-May-June 1984. In Italian with English summ. SFA 29(4)
[Dip. Biol. Anim., Univ. Torino, Acad. Albertina, 17-10123 Torino, Italy]

84-002738 Bjornn, T. C. and R. R. Ringe. EVALUATION OF RACEWAY LOADING AND SERIAL REUSE OF WATER FOR REARING STEELHEAD TROUT. *Idaho Coop. Fish. Res. Unit Tech. Rep.* 84-5. iv+31p. Sept. 1984. SFA 29(4)

TROUT AND SALMON CULTURE (CONTINUED)

84-002738 CONTINUED
[Idaho Coop. Fish. Res. Unit, Univ. Idaho, Moscow 83843] Steelhead trout reared in temporary raceways at density indices as high as 0.5 (3.8 lbs/ft$^3$) grew almost as fast and had similar mortality rates as fish at lower densities. Fish in the temporary raceways grew at rates similar to those in permanent hatchery ponds. Steelhead reared in temporary raceways with second and third use water had higher mortality rates, but grew as fast as fish in first use water. First use water added to raceways with second and third use water improved the environment (primarily dissolved oxygen concentrations) and fish health.

84-002739 Bjornn, T. C. and R. R. Ringe. EVALUATION OF TWO-YEAR REARING PROGRAM FOR STEELHEAD TROUT AT DWORSHAK NFH. *Idaho Coop. Fish. Res. Unit Tech. Rep.* 84-7. iv+35p. Sept. 1984. SFA 29(4)
[Coop. Fish. Res. Unit, Univ. Idaho, Moscow 83843]

84-002740 Craik, J. C. A. and S. M. Harvey. EGG QUALITY IN RAINBOW TROUT: THE RELATION BETWEEN EGG VIABILITY, SELECTED APSECTS OF EGG COMPOSITION, AND TIME OF STRIPPING. *Aquaculture* 40(2):115-134. 15 July 1984. SFA 29(4)
[Dunstaffnage Mar. Res. Lab., P.O. Box 3, Oban, Argyll PA34 4AD, Scotland]

84-002741 Luczynski, M. A TECHNIQUE FOR DELAYING EMBRYOGENESIS OF VENDACE (*COREGONUS ALBULA* L.) EGGS IN ORDER TO SYNCHRONIZE MASS HATCHING WITH OPTIMAL CONDITIONS FOR LAKE STOCKING. *Aquaculture* 41(2):113-117. 15 Sept. 1984. SFA 29(4)
[Inst. Ichthyobiol. Fish., Acad. Agric. Technol., 10-957 Olsztyn-Kortowo, Bl. 37, Poland] To improve the efficiency of stocking lakes with vendace (*Coregonus albula*) larvae, a technique for delaying egg hatching was developed. This synchronizes mass hatching with the development of suitable thermal conditions and food availability in the lake. Water temperatures were measured in Polish hatcheries and a mathematical model of the dependence of *C. albula* embryogenesis on incubation temperature was utilized to predict the possibilities of delaying egg hatching. Vendace hatching can be delayed by cooling the circulation water (to 1 or 2° C) during March and April. At the beginning of May, when lake conditions are optimal for stocking, the incubation temperature should be raised (at a rate of 1.5° C $h^{-1}$) to that of the water supply. This ensures mass hatching of strong, normally developed larvae within 2-3 days. This technique facilitates both the delay of vendace hatching at minimal cost and the production of larvae on demand for lake stocking.

84-002742 Mamcarz, A. and J. A. Szczerbowski. REARING OF COREGONID FISHES (COREGONIDAE) IN ILLUMINATED LAKE CAGES. I. GROWTH AND SURVIVAL OF *COREGONUS LAVARETUS* L. AND *COREGONUS PELED* GMEL. *Aquaculture* 40(2):135-145. 15 July 1984. SFA 29(4)
[Inst. Ichthyobiol. Fish., Acad. Agric. Technol., Olsztyn-Kortowo, Poland] The paper presents the results of rearing whitefish (*Coregonus lavaretus* L.) and peled (*Coregonus peled* Gmel.) in illuminated lake cages during a period of 4 years. In 3 successive years about 97 kg of summer coregonid fry were produced during initial 2-month rearing. Whitefish fry reached a length of 30.0-49.5 mm and an average individual weight of 201 mg-1 g. Peled fry reached 31.0-38.3 mm in length and 300-370 mg in weight. Whitefish survival rates amounted successively to 72.6% in 1977, 51.4% in 1978, and 3.1% in 1979. Survival rates for peled were 57.8%, 63.1% and 6%, respectively. Fishes at the age of 1+ and 2+ years showed high mortalities. Their growth rate was slower than in wild populations, and they did not attain sexual maturity.

## TROUT AND SALMON CULTURE (CONTINUED)

84-002743 Mamcarz, A. REARING OF COREGONID FISHES (COREGONIDAE) IN ILLUMINATED LAKE CAGES III. PHENOTYPIC VARIABILITY IN BODY SIZE OF *COREGONUS PELED* GMEL. DURING THE FIRST YEAR. *Aquaculture* 40(3):241-250. 1 Aug. 1984. SFA 29(4)
[Inst. Ichthyobiol. Fish., Acad. Agric. Technol., 10-957 Olsztyn-Kortowo, Poland]

84-002744 McKay, L. R.; G. W. Friars and P. E. Ihssen. GENOTYPE × TEMPERATURE INTERACTIONS FOR GROWTH OF RAINBOW TROUT. *Aquaculture* 41(2):131-140. 15 Sept. 1984. SFA 29(4)
[Dep. Anim. Poultry Sci., Univ. Guelph, Guelph, ON N1G 2W1, Canada]

84-002745 Szczerbowski, J. A. and A. Mamcarz. REARING OF COREGONID FISHES (COREGONIDAE) IN ILLUMINATED LAKE CAGES. II. ENVIRONMENTAL CONDITIONS DURING FISH REARING. *Aquaculture* 40(2):147-161. 15 July 1984. SFA 29(4)
[Inst. Ichthyobiol. Fish., Acad. Agric. Technol., Olsztyn-Kortowo, Poland] Observations of changes taking place in the environmental conditions during the rearing of coregonid fish (*Coregonus lavaretus* L. and *Coregonus peled* Gmel.) in illuminated lake cages revealed that physical factors (water temperature, oxygen, transparency) were similar in the vicinity of cages and in other parts of the lake. The abundance of zooplankton near the cages increased at night 1.4-fold, in relation to the daytime value, because organisms were attracted by the light. Relatively high amounts of food for fishes kept in the cages occurred only during about 4 months of the year. The numbers of rotifers around cages was 1.2 times higher than in the cages, whereas those of Copepods and Cladocera were 1.4-fold higher. Along with the plankton, several fish species gathered around illuminated cages: viz. bleak (*Alburnus alburnus* L.), perch (*Perca fluviatilis* L.), roach (*Rutilus rutilus* L.) and other small fishes. They fed in the same way as the fishes in the cages and thus constituted a factor limiting plankton numbers in cages.

## OTHER ANADROMOUS SPECIES CULTURE

84-002746 Geiger, J. G. ROLE OF HATCHERIES IN STRIPED BASS AND HYBRID STRIPED BASS MANAGEMENT. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 6:5. 1984. Abstract only. SFA 29(4)
[Tex. Parks Wildl. Dep., Austin 78744] Stiped bass (*Morone saxatilis*) and striped bass x white bass (*M. chrysops*) hybrids are widely utilized as both sport fish and as predators for controlling gizzard shad (*Dorosoma cepedianum*) and other forage fish populations in Southeastern reservoirs. Texas fish hatcheries in 1983 stocked 2.5 million striped bass and 1.5 million hybrid striped bass fingerlings in support of their primary objective of producing the numbers of fish requested for distribution to designated Texas public waters. Fish hatchery biologists have continually strived to improve and refine the methods for broodstock and fingerling hauling and transportation, for spawning broodfish, and for increased efficiencies for survival and growth of fry and fingerlings during the pond grow-out period in order to produce a quality, healthy fingerling for stocking. Improved methods for pond fertilization, zooplankton sampling and manipulation, and increased knowledge of zooplankton dynamics in rearing ponds have resulted in improved survival and growth of fingerlings which exhibit increased resistance to the stresses of harvesting, transportation, and stocking. Proposed improvements to the spawning and rearing facilities at the Dundee and Possum Kingdom State Fish Hatcheries should result in stronger fry with a subsequent reduction in observed mortalities occasionally seen 24-48 hours after stocking in ponds. Continued improvements in harvesting, handling, and transportation of fingerlings should help to further reduce stress and

OTHER ANADROMOUS SPECIES CULTURE (CONTINUED)

84-002746 CONTINUED improve stocking success. The ultimate result of all these efforts should be larger numbers of trophy fish for Texas anglers.

## WARMWATER CULTURE

84-002747 Boney, S. T.; W. L. Shelton; S. Yang and L. O. Wilken. SEX REVERSAL AND BREEDING OF GRASS CARP. *Trans. Am. Fish. Soc.* 113(3):348-353. May 1984. SFA 29(4)
[Ala. Coop. Fish. Res. Unit, Auburn Univ., Auburn, AL 36849]

84-002748 Buddle, C. R. ANDROGEN-INDUCED SEX-INVERSION OF *OREOCHROMIS* (TREWAVAS) HYBRID FRY STOCKED INTO CAGES STANDING IN AN EARTHEN POND. *Aquaculture* 40(3):233-239. 1 Aug. 1984. SFA 29(4)
[RHM Aquacult. Dev., Ltd., New Road, Drox Selby, Yorkshire YO8 8PX, England]

84-002749 Gonzales, E. R. SMALL SCALE TILAPIA CAGE TECHNOLOGY ADOPTED IN FISHING VILLAGES IN LAGUNA LAKE, PHILIPPINES. *Aquaculture* 41(2):161-169. 15 Sept. 1984. SFA 29(4)
[Binangonan Res. Stn., Aquacult. Dep., Southeast Asian Fish. Dev. Cent., Binangonan, Rizal, Philippines]

84-002750 Henderson-Arzapalo, A. and R. R. Stickney. PRODUCING MARKET-SIZE TILAPIA IN ONE GROWING SEASON. *Proc. Fish Farm. Conf. Annu. Conv. Fish Farm. Tex.* 1984:5-32. 1984. SFA 29(4)
[Tex. Parks Wildl. Dep., Palacios] A small scale spawning and rearing facility for the production of *Tilapia aurea* fingerlings was constructed in a polyethylene-covered greenhouse. Spawning and fry rearing during the winter extended the growing season by two months. Lights and small immersion heaters were used to regulate spawning conditions in 300 gallon fiberglass tanks. *T. aurea* broodfish were stocked and allowed to spawn. The fry were subsequently collected and treated with synthetic testosterone producing only male fish. Fry hormone treatment was done in a small recirculating system to maintain temperatures above 68 °F. After hormone-treatment, fry were held indoors in tanks until outside water temperatures stabilized at 68 °F. The fish (approximately 1 inch total length) were then stocked into 0.5 acre ponds. Over a 66 day period, 59 broodfish spawned, producing 2,348 fingerlings. After 191 days of pond culture, 2,130 fish weighing an average of 1.17 lbs. were harvested. No fry were recovered from the ponds, indicating the hormone-treatment was successful. Total construction and operating costs of the fingerling production system were used in a computer budget simulation model to estimate the profitability of the system. A small facility such as the one described and equipped for research purposes would produce fingerlings at an estimated unit cost of $0.83. Reducing equipment requirements to reflect those of an individual or commercial operator lowered production costs to $0.27 per fingerling. A system that could produce 120,000 fingerlings over six months would further reduce costs to $0.18 per fingerling. A telephone survey of tilapia producers in the United States provided information on current production methods and market problems. Assessing the market demand and providing a steady source of fish to retailers appear essential to the establishment of a successful tilapia operation.

## WARMWATER CULTURE (CONTINUED)

84-002751 Lodi, E. RIPRODUZIONE INDOTTA DA GONADOTROPINA CORIONICA UMANA NEL COBITE COMUNE, *COBITIS TAENIA BILINEATA* CANESTRINI (OSTEICHTHYES, COBITIDAE). [ARTIFICIAL SPAWNING INDUCED BY HUMAN CHORIONIC GONADOTROPIN IN ITALIAN SPINED LOACH, *COBITIS TAENIA BILINEATA* CANESTRINI (OSTEICHTHYES, COBITIDAE).] *Riv. Ital. Pisic. Ittiop.* 19(2):44-52. Apr.-May-June 1984. In Italian with English summ. SFA 29(4)
[Dip. Biol. Anim., Univ. Torino, Acad. Albertina, 17-10123 Torino, Italy]

84-002752 Williams, K.; G. E. Gebhart and O. E. Maughan. ECONOMIC ANALYSIS OF SMALL-SCALE CAGE CHANNEL CATFISH-BLUE TILAPIA POLYCULTURE. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 6:36-41. 1984. SFA 29(4)
[Agric. Res. Cent., Langston Univ., Langston, OK 73050] Production results from research with caged channel catfish *Ictalurus punctatus*-blue tilapia *Tilapia aurea* polyculture were used to formulate enterprise wholesale and retail budgets for the Oklahoma area. Budgets were based on the total production from three 1-$m^3$ cages in a 0.4-hectare pond. The wholesale budget showed a net loss of $104.07 after estimated labor costs were added; retail budgets for live and dressed fish showed profits of $426.32 and $604.67, respectively.

## MARICULTURE

84-002753 Lutes, P. B. OVARIAN MATURATION AND INDUCED SPAWNING IN THE WHITE STURGEON (*ACIPENSER TRANSMONTANUS* RICHARDSON). *Ph.D. dissertation, Univ. Calif. (Davis)* 84p. 1983. From Diss. Abstr. Int. B Sci. Eng. 45(2):450. Aug. 1984. SFA 29(4)

84-002754 Robinson, E. H.; W. H. Daniels; C. D. Williams and W. A. Wurts. DIET DEVELOPMENT AND ENVIRONMENTAL ION REQUIREMENTS FOR FINGERLING REDFISH (*SCIAENOPS OCELLATUS*). *Proc. Fish Farm. Conf. Annu. Conv. Fish Farm. Tex.* 1984:44-50. 1984. SFA 29(4)
[Dep. Wildl. Fish. Sci., Tex. A & M Univ., College Station 77843]

## FEEDS, FEEDING, AND NUTRITION

84-002755 Al Asgah, N. A. and R. M. Bedawi. EFFICIENCY OF LOCAL FEEDS FOR THE COMMON CARP (*CYPRINUS CARPIO* L.) IN SAUDI ARABIA. *Aquaculture* 40(4):363-365. 15 Aug. 1984. SFA 29(4)
[R.M. Bedawi: Zool. Dep., Coll. Sci., King Saud Univ., Riyadh, Saudi Arabia]

84-002756 Allahpichay, I. and C. Shimizu. [EXTRACTION OF GROWTH PROMOTING FRACTIONS FROM NON-MUSCLE KRILL MEAL OF *EUPHAUSIA SUPERBA* AND ITS EFFECT ON FISH GROWTH.] *Bull. Jpn. Soc. Sci. Fish.* 50(5):821-826. May 1984. In Japanese with English summ. SFA 29(4)
[System Science Consultants, Ichigaya-Sadohara, Shinjuku, Tokyo 162, Japan]

FEEDS, FEEDING, AND NUTRITION (CONTINUED)

84-002757 Allapichay, I. and C. Shimizu. [SUPPLEMENTAL EFFECT OF THE WHOLE BODY KRILL MEAL AND THE NON-MUSCLE KRILL MEAL OF *EUPHAUSIA SUPERBA* IN FISH DIET.] *Bull. Jpn. Soc. Sci. Fish.* 50(5):815-820. May 1984. In Japanese with English summ. SFA 29(4)
[System Science Consultants, Ichigaya-Sadohara, Shinjuku, Tokyo 162, Japan]

84-002758 Charles, P. M.; S. M. Sebastian; M. C. V. Raj and M. P. Marian. EFFECT OF FEEDING FREQUENCY ON GROWTH AND FOOD CONVERSION OF *CYPRINUS CARPIO* FRY. *Aquaculture* 40(4):293-300. 15 Aug. 1984. SFA 29(4)
[M. P. Marian: Sch. Biol. Sci., Madurai Kamaraj Univ., Madurai 625 021, India]

84-002759 Charlon, N. and P. Bergot. REARING SYSTEM FOR FEEDING FISH LARVAE ON DRY DIETS. TRIAL WITH CARP (*CYPRINUS CARPIO* L.) LARVAE. *Aquaculture* 41(1):1-9. 1 Sept. 1984. SFA 29(4)
[Lab. Nutr. Elevage Poissons, I.N.R.A., Cent. Rech. Hydrobiol. B.P. 3, Saint Pée-sur-Nivelle, 64310 Ascain, France]

84-002760 Choubert, G.; J. M. Blanc and P. Luquet. INFLUENCE DE LA MODIFICATION DE LA FRÉQUENCE DE DISTRIBUTION DES REPAS SUR LA DIGESTIBILITÉ DU RÉGIME ALIMENTAIRE CHEZ LA TRUITE ARC-EN-CIEL. [INFLUENCE OF A CHANGE IN FEEDING FREQUENCY ON DIET DIGESTIBILITY IN RAINBOW TROUT.] *Ann. Zootech.* 33(2):255-262. 1984. In French with English summ. SFA 29(4)
[I.N.R.A. Lab. Nutr. Elevage Poissons, Cent. Rech. Hydrobiol., Saint-Pée-sur-Nivelle, F-64310 Ascain, France]

84-002761 Dabrowski, K.; N. Charlon; P. Bergot and S. Kaushik. REARING OF COREGONID (*COREGONUS SCHINZI PALEA* CUV. ET VAL.) LARVAE USING DRY AND LIVE FOOD. I. PRELIMINARY DATA. *Aquaculture* 41(1):11-20. 1 Sept. 1984. SFA 29(4)
[Lab. Nutr. Elevage Poissons, I.N.R.A., Cent. Rech. Hydrobiol. B.P.3, Saint Pée-sur-Nivelle, 64310 Ascain, France]

84-002762 Degani, G.; D. Levanon and G. Trieger. PRELIMINARY STUDY ON THE INFLUENCE OF DIFFERENT FEEDS ON MORTALITY AND GROWTH OF EELS (*ANGUILLA ANGUILLA* L.) IN THE INITIAL PERIOD. *Bamidgeh* 36(2):47-52. June 1984. SFA 29(4)
[Galilee Technol. Cent., Kiryat Shmona, Israel] This study examined the influence of different diets on the mortality and growth in elvers of the European eel *(Anguilla anguilla)* during the initial nursing period. The growth of elvers that were fed chicken meal and chicken blood (Gr.2) was lower than the growth of elvers fed chicken meal and raw chicken meat (Gr.1) and fish meal and raw chicken meat (Gr.3). No significant difference was found at the end of the experiment between number of fish in Gr. 1 and Gr. 3, however, the mortality was higher in Gr. 2 than the other groups.

84-002763 Falls, W. W. FOOD HABITS AND FEEDING SELECTIVITY OF LARVAE OF THE STRIPED BASS *MORONE SAXATILIS* (WALBAUM) (OSTEICHTHYES; PERCICHTHYIDAE) UNDER INTENSIVE CULTURE CONDITIONS. *Ph.D. dissertation, Univ. South Miss.* 112p. 1983. From Diss. Abstr. Int. B Sci. Eng. 45(3):733. Sept. 1984. SFA 29(4)

FEEDS, FEEDING, AND NUTRITION (CONTINUED)

84-002764 Fauconneau, B. and P. Luquet. INFLUENCE DE LA FRÉQUENCE DE DISTRIBUTION DES PROTÉINES SUR LA CROISSANCE ET L'EFFICACITÉ ALIMENTAIRE CHEZ LA TRUITE ARC-EN-CIEL (*SALMO GAIRDNERI* R.). [INFLUENCE OF PROTEIN FEEDING FREQUENCY ON GROWTH AND FEED EFFICIENCY OF RAINBOW TROUT (*SALMO GAIRDNERI* R.).] *Ann. Zootech.* 33(2):245-254. 1984. In French with English summ. SFA 29(4)

[I.N.R.A. Lab. Nutr. Elevage Poissons, Cent. Rech. Hydrobiol., Saint-Pée-sur-Nivelle, F-64310 Ascain, France]

84-002765 Gatlin, D. M. III and R. P. Wilson. STUDIES ON THE MANGANESE REQUIREMENT OF FINGERLING CHANNEL CATFISH. *Aquaculture* 41(2):85-92. 15 Sept. 1984. SFA 29(4)

[Dep. Biochem., Miss. State Univ., Mississippi State 39762] Fingerling channel catfish (*Ictalurus punctatus*) were fed purified diets containing varying levels of manganese for 13 weeks in two experiments. Weight gain and feed efficiency data of catfish fed the basal diet (2.4 mg Mn/kg diet) were not significantly different from those of catfish fed manganese-supplemented diets in both experiments. Liver manganese superoxide dismutase activity, liver manganese concentration, serum alkaline phosphatase activity and hexosamine content of gill filament cartilage did not differ in catfish fed basal and manganese-supplemented diets. Bone manganese concentration increased almost linearly with increasing dietary manganese levels. The 2.4 mg Mn/kg supplied by the basal diet was apparently sufficient to meet the manganese requirement of fingerling channel catfish during these experiments.

84-002766 Gatlin, D. M. III and R. P. Wilson. ZINC SUPPLEMENTATION OF PRACTICAL CHANNEL CATFISH DIETS. *Aquaculture* 41(1):31-36. 1 Sept. 1984. SFA 29(4)

[Dep. Biochem., Miss. State Univ., Mississippi State 39762] A 10-week feeding trial was conducted with fingerling channel catfish (*Ictalurus punctatus*) to determine the supplemental zinc level needed in a practical catfish diet. As phytic acid has been demonstrated to reduce zinc bioavailability, diets in this study were formulated to contain a relatively high level of phytic acid as compared to most commercial catfish diets. Incremental levels of zinc (as ZnO) were added to a soybean meal-based diet which contained 54 mg Zn/kg dry diet and 1.1% phytic acid. Catfish growth and feed efficiency were not improved with zinc supplementation. Serum zinc concentration did not increase significantly above a supplemental zinc level of 100 mg Zn/kg diet; whereas, bone zinc concentration plateaued at the 150 mg/kg supplemental zinc level and above. Based on these data a supplemental zinc level of 150 mg Zn/kg diet is recommended for practical catfish feeds to provide enough available zinc to the channel catfish.

84-002767 Ghosh, S. K.; B. K. Mandal and D. N. Borthakur. EFFECTS OF FEEDING RATES ON PRODUCTION OF COMMON CARP AND WATER QUALITY IN PADDY-CUM-FISH CULTURE. *Aquaculture* 40(2):97-101. 15 July 1984. SFA 29(4)

[Div. Fish., ICAR Res. Complex for N.E.H. Reg., Laban, Shillong-793004, Meghalaya, India]

84-002768 Jackson, A. J.; A. K. Kerr and A. M. Bullock. FISH SILAGE AS A DIETARY INGREDIENT FOR SALMON. II. PRELIMINARY GROWTH FINDINGS AND NUTRITIONAL PATHOLOGY. *Aquaculture* 40(4):283-291. 15 Aug. 1984. SFA 29(4)

[Dunstaffnage Mar. Res. Lab., P.O. Box 3, Oban, Argyll, Scotland]

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84-002769 Knox, D.; C. B. Cowey and J. W. Adron. EFFECTS OF DIETARY ZINC INTAKE UPON COPPER METABOLISM IN RAINBOW TROUT *(SALMO GAIRDNERI)*. *Aquaculture* 40(3):199-207. 1 Aug. 1984. SFA 29(4)
[Inst. Mar. Biochem., St. Fittick's Rd., Torry, Aberdeen AB1 3RA, Scotland]

84-002770 Lubzens, E.; G. Sagie; G. Minkoff; E. Meragelman and A. Schneller. ROTIFERS *(BRACHIONUS PLICATILIS)* IMPROVE GROWTH RATE OF CARP *(CYPRINUS CARPIO)* LARVAE. *Bamidgeh* 36(2):41-46. June 1984. SFA 29(4)
[Dep. Biol., Technion, Haifa, Israel] Carp larvae *(Cyprinus carpio)* raised on a mixed diet of artificial food and rotifers *(Brachionus plicatilis)* grew three times faster than those fed on artificial food alone. Best development was obtained by feeding larvae on a combination of artificial food and rotifers supplied at a density of 5 $ml^{-1}$. Increasing rotifer density to 20 $ml^{-1}$ reduced larval growth rate in the presence or absence of artificial food. These results suggest that the euryhaline rotifer *Brachionus plicatilis*, widely used in mariculture, can be successfully used also in freshwater aquaculture. Adding rotifers to carp larvae diet, enhanced growth permitting either a higher turnover of carp larvae production in the hatchery or in the introduction of larger larvae into outdoor fish ponds.

84-002771 Murai, T.; T. Akiyama and T. Nose. [EFFECT OF AMINO ACID BALANCE OF EFFICIENCY IN UTILIZATION OF DIET BY FINGERLING CARP.] *Bull. Jpn. Soc. Sci. Fish.* 50(5):893-897. May 1984. In Japanese with English summ. SFA 29(4)
[Div. Fish. Nutr., Natl. Res. Inst. Aquacult., Tamaki, Watarai, Mie 519-04, Japan]

84-002772 Noeske, T. A. and R. E. Spieler. CIRCADIAN FEEDING TIME AFFECTS GROWTH OF FISH. *Trans. Am. Fish. Soc.* 113(4):540-544. July 1984. SFA 29(4)
[Milwaukee Publ. Mus., 800 West Wells St., Milwaukee, WI 53233]

84-002773 Rehulka, J. THE EFFECT OF SULPHITE YEASTS AND POULTRY MEAL IN FEED MIXTURE ON RED BLOOD PICTURE AND TOTAL BLOOD SERUM PROTEIN IN MARKET RAINBOW TROUT (*SALMO GAIRDNERI* R.). *Pr. Vodnany* No. 13. p.75-81. 1984. In English with Czech summ. SFA 29(4)
[Vyzkumny ústav Rybái. Hydrobiol. Vodnany, Prac. Varenská 51, 702 00 Ostrava, Czechoslovakia]

84-002774 Sampath, K. PRELIMINARY REPORT ON THE EFFECTS OF FEEDING FREQUENCY IN *CHANNA STRIATUS*. *Aquaculture* 40(4):301-306. 15 Aug. 1984. SFA 29(4)
[Dep. Zool., Aditanar Coll. Arts Sci., Tiruchendur 628 216, India]

84-002775 Schmitz, O; E. Greuel and E. Pfeffer. DIGESTIBILITY OF CRUDE PROTEIN AND ORGANIC MATTER OF POTENTIAL SOURCES OF DIETARY PROTEIN FOR EELS (*ANGUILLA ANGUILLA*, L.). *Aquaculture* 41(1):21-30. 1 Sept. 1984. In English with German summ. SFA 29(4)
[Inst. Tierernährung, Univ. Bonn, D-5300 Bonn, West Germany]

84-002776 Tabachek, J. L. EVALUATION OF GROWER DIETS FOR INTENSIVE CULTURE OF TWO STRAINS OF ARCTIC CHARR (*SALVELINUS ALPINUS* L.). *Can. Tech. Rep. Fish. Aquatic Sci.* No. 1281. iv+21p. July 1984. SFA 29(4)

FEEDS, FEEDING, AND NUTRITION (CONTINUED)

84-002776 CONTINUED
[Dep. Fish. Oceans, Winnipeg, MB R3T 2N6, Canada] In two experiments, Arctic charr and rainbow trout (*Salmo gairdneri* Richardson) from Sunndalsora, Norway and Arctic charr from Labrador, Canada were fed up to five trout and/or salmon diets. The control (CTR) diet appeared to be a suitable practical diet for use in determining the nutritional requirements of either strain of Arctic charr. Performance (weight gain and feed conversion) of Labrador charr was superior to that of Sunndalsora charr and was equivalent to or slightly better than rainbow trout fed the same diets [Martin Feed Mills GRT Trout Feed (MTT-GRT) and CTR]. In addition, performance of Labrador charr was also excellent with Martin Feed Mills MNR Trout Feed (MTT-MNR). Not all trout or salmon diets were suitable for production of both strains of Arctic charr. While MTT-GRT was an acceptable diet for both rainbow trout and Labrador charr, it was an unacceptable diet for Sunndalsora charr. Although the liver lipid content was elevated in both strains of charr fed MTT-GRT, CTR or MTT-MNR, it was not elevated in trout fed the same diets or Sunndalsora charr fed other diets. However, the muscle lipid contents of trout fed CTR or MTT-GRT tended to be slightly higher than charr fed the same diets and much higher than Sunndalsora charr fed other diets.

84-002777 Tacon, A. G. J.; D. Knox and C. B. Cowey. EFFECT OF DIFFERENT DIETARY LEVELS OF SALT-MIXTURES ON GROWTH AND BODY COMPSITION IN CARP. *Bull. Jpn. Soc. Sci. Fish.* 50(7):1217-1222. July 1984. SFA 29(4)
[Inst. Aquacult, Univ. Stirling, Stirling FK9 4LA, England] A 56-day feed trial was conducted to examine the effect of feeding graded levels of a salt-mixture (0-6%), as compared with an established mineral supplement (4%, McCollum's salt-mixture no. 185 plus trace elements), on the growth and body composition of carp. Fish fed the ration containing 4% McCollum's salt-mixture plus trace elements displayed the highest overall growth response and feed efficiency over the experimental test period. For those fish fed graded levels of the salt-mixtures, maximum growth was obtained at the 2% inclusion level. In contrast to fish fed mineral supplemented rations, fish fed a ration containing no mineral supplement displayed reduced growth, low feed efficiency, loss of muscle tone, decreased heamatocrit, decreased haemoglobin and serum glucose concentration, elevated carcass moisture, Ca, P and Na content, and reduced carcass protein, lipid, Mg, Fe, Zn and Cu content. The data present indicates the necessity of a dietary mineral supplement for carp fed a purified ration based on casein, potato starch, dextrin and lipid.

84-002778 Takii, K.; M. Takeda and Y. Nakao. [EFFECTS OF SUPPLEMENT OF FEEDING STIMULANTS TO FORMULATED FEEDS ON FEEDING ACTIVITY AND GROWTH OF JUVENILE EEL.] *Bull. Jpn. Soc. Sci. Fish.* 50(6):1039-1043. June 1984. In Japanese with English summ. SFA 29(4)
[Lab. Fish Nutr., Fac. Agric., Kochi Univ., Nankoku, Kochi 783, Japan]

84-002779 Watanabe, T.; A. Itoh; A. Murakami; Y. Tsukashima; C. Kitajima and S. Fujita. EFFECT OF NUTRITIONAL QUALITY OF DIETS GIVEN TO BROODSTOCK ON THE VERGE OF SPAWNING ON REPRODUCTION OF RED SEA BREAM. *Bull. Jpn. Soc. Sci. Fish.* 50(6):1023-1028. June 1984. SFA 29(4)
[Lab. Fish Nutr., Tokyo Univ. Fish., Konan 4, Minato, Tokyo 108, Japan]

84-002780 Watanabe, T.; A. Itoh; C. Kitajima and S. Fujita. EFFECT OF DIETARY PROTEIN LEVELS ON REPRODUCTION OF RED SEA BREAM. *Bull. Jpn. Soc. Sci. Fish.* 50(6):1015-1022. June 1984. SFA 29(4)
[Lab. Fish Nutr., Tokyo Univ. Fish., Konan 4, Minato, Tokyo 108, Japan]

## FEEDS, FEEDING, AND NUTRITION (CONTINUED)

84-002781 Watanabe, T.; T. Takeuchi; M. Saito and K. Nishimura. EFFECT OF LOW PROTEIN-HIGH CALORY OR ESSENTIAL FATTY ACID DEFICIENCY DIET ON REPRODUCTION OF RAINBOW TROUT. *Bull. Jpn. Soc. Sci. Fish.* 50(7):1207-1215. July 1984. SFA 29(4)

[Lab. Fish. Nutr., Tokyo Univ. Fish., Konan 4, Minato, Tokyo 108, Japan] A feeding experiment was conducted to investigate effects of quality of diets, given to rainbow trout broodstock for 3 months before their spawning, on the reproduction and egg quality by feeding various diets, with different levels of protein and lipid or a diet without supplemental essential fatty acid (EFA). The growth rate and feed efficiency were high in the broodstock receiving the diet containing 36% protein and 18% lipid and in addition eyed rate and total hatch were also high in the eggs produced by the broodstock of this group. The growth and feed efficiency in the fish kept on the diet containing 28% protein became slow from around 60 days after feeding. Feeding the diet containing beef tallow as a part of energy source gave good results with regard to reproduction, comparable to those obtained in the broodstock fed on a commercial high protein diet. The EFA-deficient diet was found to result in low growth rates, eyed eggs and hatchability, and these results were also found to be effectively improved by supplementing ethyl linoleate to the diet, indicating importance of EFA for reproduction. The results of this study have demonstrated that egg quality was greatly affected by the nutritional quality of diets given to rainbow trout broodstock for a short-period of 3 months before their spawning.

84-002782 Yoshida, H. and Y. Sakurai. [RELATIONSHIP BETWEEN FOOD CONSUMPTION AND GROWTH OF ADULT WALLEYE POLLOCK *THERAGRA CHALCOGRAMMA* IN CAPTIVITY.] *Bull. Jpn. Soc. Sci. Fish.* 50(5):763-769. May 1984. In Japanese with English summ. SFA 29(4)

[Res. Inst. North Pac. Fish., Fac. Fish., Hokkaido Univ., Hokodate 041, Japan] Food consumption rate and growth rate of the adult walleye pollock were measured at different temperatures (2-7, 4-10, and 9-15 °), body sizes (33-35, 35-39 and 39-45cm) and foods (juvenile walleye pollock, squid and sandlance). The amount of daily intake indicated peaks at intervals of 5 days. The efficiency of assimilation was almost constant for range of temperature and body size, and for each food item adapted in these experiments. However, the efficiency of dissimilation increased with the increase in temperature. An empirical linear equation was established on the relationship between daily feeding rate (R) and daily growth rate (G) at 2-7 °C: $G = 0.370R - 0.225$. Body weight and condition factor increased linearly with increase of ration, but body length increased asymptotically. Estimated food requirements of adult walleye pollock was 1.1% of body weight per day.

## TRANSPORTING FISH

84-002783 Carmichael, G. J. and J. R. Tomasso. CHARACTERIZATION AND ALLEVIATION OF HAULING-INDUCED STRESS IN LARGEMOUTH BASS. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 6:22. 1984. Abstract only. SFA 29(4)

[U.S. FWS, San Marcos Fish Hatchery Dev. Cent., San Marcos, TX 78666] Stress and mortalities associated with long-term truck transport of advanced (200 g, 21 cm) largemouth bass *Micropterus salmoides* have long been recognized. Our objectives were to characterize stress during and after hauling periods of up to 30 hours at a density of 100 g fish/liter of water and to develop methods to reduce stress and mortalities. Plasma corticosteroid and glucose concentrations were used as general indicators of hualing stress and changes in plasma chloride concentrations and osmolality as indicators of osmoregulatory dysfunction. Fish transported via truck had

## TRANSPORTING FISH (CONTINUED)

84-002783 CONTINUED significantly elevated plasma corticosteroid and glucose concentrations and decreased plasma chloride concentrations and osmolality. Significant mortality was associated with hauls of 24 and 30 hours (38% and 83-92%, respectively). Plasma characteristics returned to near normal values 3 to 28 days after hauling with recovery time related to length of haul and associated mortality. Mortality and sublethal stress were reduced significantly (0% mortality during and following a 30-hour haul) when fish were transported and handled as follows: 1. prophylactic disease treatment for 10 days prior to hauling; 2. pre-haul starvation for 72 hours; 3. pre-capture (post-crowding) anesthesia with MS-222 (50 mg/liter); 4. haul in water containing salts nearly isotonic to fish plasma (NaCl, KCl, $KH_2PO_4$, $MGSO_4$, along with high native calcium and bicarbonate), anesthetic (MS-222, 25 mg/liter), anti-bacterial compound (10 mg/liter oxytetracycline), using cool temperatures (16 C); 5. post-haul ionic tempering in salts nearly isotonic to fish plasma for 24 hours; 6. post-haul prophylactic disease treatment for 10 days.

84-002784 Congleton, J. L.; T. C. Bjornn; C. A. Robertson; J. L. Irving and R. R. Ringe. EVALUATING THE EFFECTS OF STRESS ON THE VIABILITY OF CHINOOK SALMON SMOLTS TRANSPORTED FROM THE SNAKE RIVER TO THE COLUMBIA RIVER ESTUARY. *Idaho Coop. Fish. Res. Unit Tech. Rep.* 84-4. vi + 67p. June 1984. SFA 29(4)
[Idaho Coop. Fish. Res. Unit, Univ. Idaho, Moscow 83843]

## AQUARIUMS

84-002785 Elias, J. BREEDING *CAPOETA ARULIUS* - THE LONGFIN BARB. *Trop. Fish Hobbyist* 33(3):10-16. Nov. 1984. SFA 29(4)

## MISCELLANEOUS CULTURE TECHNIQUES AND EQUIPMENT

84-002786 Horsch, C. M. THE USE OF A NATURAL ZEOLITE AS BOTH AN ION-EXCHANGE AND BIOLOGICAL FILTER MEDIA AT EAGLE CREEK NATIONAL FISH HATCHERY. *Salmonid* 7(6):12-15. Mar.-Apr. 1984. SFA 29(4)
[U.S. FWS, Eagle Creek Natl. Fish Hatchery, Estacada, OR]

84-002787 Konstantinov, A. S. and M. Y. Pelipenko. USE OF ZEOLITE TO REMOVE TOXIC SUBSTANCES FROM NITROGEN METABOLISM OF FISHES. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(6):159-161. 1983. SFA 29(4)
[Biol. Fac., Moscow State Univ., Moscow, USSR]

84-002788 Stoner, A. W. DISTRIBUTION OF FISHES IN SEAGRASS MEADOWS: ROLE OF MACROPHYTE BIOMASS AND SPECIES COMPOSITION. *NOAA Fish. Bull.* 81(4):837-846. Oct. 1983. SFA 29(4)
[Cent. Energy Environ. Res., Univ. Puerto Rico, Mayagüez, PR 00708]

## CHEMICAL LIMNOLOGY AND OCEANOGRAPHY

84-002789 El-Shaarawi, A. H. and M. A. Neilson. CHANGES IN NUTRIENT LEVELS OF LAKE WATER STORED AT 4°C. *Can. J. Fish. Aquatic Sci.* 41(6):985-988. June 1984. In English with French summ. SFA 29(4)

CHEMICAL LIMNOLOGY AND OCEANOGRAPHY (CONTINUED)

84-002789 CONTINUED
[Dep. Environ., Natl. Water Res. Inst., Can. Cent. Inland Waters, Burlington, ON L7R 4A6, Canada]

84-002790 Geesey, G. G.; G. V. Alexander; R. N. Bray, and A. C. Milller. FISH FECAL PELLETS ARE A SOURCE OF MINERALS FOR INSHORE REEF COMMUNITIES. *Mar. Ecol. Prog. Ser.* 15(1-2): 19-25. 1984. From Deep-Sea Res. B Oceanogr. Lit. Rev. 31(8):550. 1984. SFA 29(4)
[Dep. Microbiol., Calif. State Univ., Long Beach 90840]

## BENTHOS

84-002791 Gerber, R. B. and A. Benson. AUTUMNAL TERRESTRIAL AND AQUATIC INVERTEBRATE DRIFT IN A WEST VIRGINIA COLD WATER STREAM. *Proc. W. Va. Acad. Sci.* 52(2):47-57. 1980. SFA 29(4)
[Biol. Dep., W. Va. Univ., Morgantown 26506]

## PLANKTON

84-002792 Bird, D. F. and J. Kalff. EMPIRICAL RELATIONSHIPS BETWEEN BACTERIAL ABUNDANCE AND CHLOROPHYLL CONCENTRATION IN FRESH AND MARINE WATERS. *Can. J. Fish. Aquatic Sci.* 41(7):1015-1023. July 1984. In English with French summ. SFA 29(4)
[Dep. Biol., McGill Univ., 1205 Ave. Dr. Penfield, Montreal, PQ H3A 1B1, Canada]

84-002793 Pace, M. L. ZOOPLANKTON COMMUNITY STRUCTURE, BUT NOT BIOMASS, INFLUENCES THE PHOSPHORUS-CHOLORPHYLL *a* RELATIONSHIP. *Can. J. Fish. Aquatic Sci.* 41(7):1089-1096. July 1984. In English with French summ. SFA 29(4)
[Dep. Oceanogr., Univ. Hawaii, 1000 Pope St., Honolulu, HI 96822]

## MORPHOLOGY

84-002794 Adamicka, P. ON THE CONSTRUCTION OF THE PONTIC CYPRINID *PELECUS CULTRATUS* (L.) FACTS AND SURMISES. *Arch. Hydrobiol.* 101(1-2):9-19. 1984. SFA 29(4)
[Biol. Stn., A-3293, Lunz, Austria]

84-002795 Azevedo, C. DEVELOPMENT AND ULTRASTRUCTURAL AUTORADIOGRAPHIC STUDIES OF NUCLEOLUS-LIKE BODIES (NUAGES) IN OOCYTES OF A VIVIPAROUS TELEOST (*XIPHOPHORUS HELLERI*). *Cell Tissue Res.* 238(1):121-128. Sept. 1984. SFA 29(4)
[Dep. Cell Biol., Inst. Biomed. Sci., Univ. Oporto, Lg. A. Salazar, 4000 Porto-Portugal]

MORPHOLOGY (CONTINUED)

84-002796 Baumann, P. C. and S. J. Hamilton. VERTEBRAL ABNORMALITIES IN WHITE CRAPPIES, *POMOXIS ANNULARIS* RAFINESQUE, FROM LAKE DECATUR, ILLINOIS, AND AN INVESTIGATION OF POSSIBLE CAUSES. *J. Fish Biol.* 25(1):25-33. July 1984. SFA 29(4)
[U.S. FWS, Columbia Natl. Fish Hatchery, Rt. 1, Columbia, MO 65201]

84-002797 Billard, R. ULTRASTRUCTURAL CHANGES IN THE SPERMATOGONIA AND SPERMATOCYTES OF *POECILIA RETICULATA* DURING SPERMATOGENESIS. *Cell Tissue Res.* 237(2):219-226. Aug. 1984. SFA 29(4)
[I.N.R.A., Lab. Physiol. Poissons, Campus de Beaulieu, Rennes, France]

84-002798 Blouw, D. M. and D. W. Hagen. THE ADAPTIVE SIGNIFICANCE OF DORSAL SPINE VARIATION IN THE FOURSPINE STICKLEBACK, *APELTES QUADRACUS*. I. GEOGRAPHIC VARIATION IN SPINE NUMBER. *Can. J. Zool.* 62(7):1329-1339. July 1984. In English with French summ. SFA 29(4)
[Dep. Biol., St. Francis Xavier Univ., Antigonish, NS B2G 1C0, Canada]

84-002799 Blouw, D. M. and D. W. Hagen. THE ADAPTIVE SIGNIFICANCE OF DORSAL SPINE VARIATION IN THE FOURSPINE STICKEBACK, *APELTES QUADRACUS*. II. PHENOTYPE-ENVIRONMENT CORRELATIONS. *Can. J. Zool.* 62(7):1340-1350. July 1984. In English with French summ. SFA 29(4)
[Dep. Biol., St. Francis Xavier Univ., Antigonish, NS B2G 1C0, Canada]

84-002800 Caceci, T. SCANNING ELECTRON MICROSCROPY OF GOLDFISH, *CARASSIUS AURATUS*, INTESTINAL MUCOSA. *J. Fish Biol.* 25(1):1-12. July 1984. SFA 29(4)
[Dep. Vet. Anat., Coll. Vet. Med., Tex. A&M Univ., College Station 77843]

84-002801 Campana, S. E. FACTORS AFFECTING THE PRODUCTION OF DAILY GROWTH INCREMENTS IN THE OTOLITHS OF FISHES. *Ph.D. dissertation, Univ. British Columbia* 1983. From Diss. Abstr. Int. B Sci. Eng. 45(2):482. Aug. 1984. SFA 29(4)

The objective of this thesis was to assess the influence of some environmental variables on the otolith microstructure of fishes. Daily growth increment production and check formation were examined in a variety of species under both laboratory and field conditions. Laboratory experiments on juvenile fish demonstrated that daily growth increments were produced in the absence of a diel light or temperature regime. Since these results were apparently inconsistent with published studies using larval fishes, a subsequent series of experiments examined the interaction of fish age with light and/or temperature. Age was an important modifier of the influence of photoperiod on an internal circadian rhythm. Diel temperature fluctuations did not entrain increment production, but did affect the appearance of microstructural features. A suggested mechanism for daily increment production is consistent with a finding that feeding periodicity does not affect the number of daily increments formed, but may affect the appearance of the otolith growth record. Ca-45 was used to monitor otolith deposition through periods of stress (check formation). Stress resulted in a marked decrease in the uptake of calcium from the ambient water; a calcium-deficient structure (check) resulted. No resorption of previously-deposited calcium was observed. In a final section, biweekly patterns of increment width and appearance in wild marine fish were examined. The results of a multiple regression model suggest that tidal influences on temperature and/or salinity can explain much of the periodic variation in growth and appearance. Through an unknown mechanism, checks were formed at weekly or biweekly intervals in synchronization with the phases of the moon.

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84-002802 Claeys, H. and P. Aerts. NOTE ON THE COMPOUND LOWER PHARYNGEAL JAW OPERATORS IN *ASTATOTILAPIA ELEGANS* (TREWAVAS), 1933 (TELEOSTEI: CICHLIDAE). *Neth. J. Zool.* 34(2):210-214. Aug. 1984. SFA 29(4)
[Lab. Morfol. Syst. Dieren, Rijksuniv. Gent, Ledeganckstr. 35, B-9000 Gent, Belgium]

84-002803 Conrad, R. H. SCALE PATTERN ANALYSIS AS A METHOD FOR IDENTIFYING THE ORIGINS OF SOCKEYE SALMON *(ONCORHYNCHUS NERKA)* IN THE WATERS SURROUNDING THE KODIAK ARCHIPELAGO. *Alaska Dep. Fish Game Inf. Leafl.* No. 241. iv+49p. Aug. 1984. SFA 29(4)
[Alaska Dep. Fish Game, Div. Commer. Fish., Anchorage]

84-002804 Coughlan, D. J. and S. P. Gloss. EARLY MORPHOLOGICAL DEVELOPMENT OF GILLS IN SMALLMOUTH BASS *(MICROPTERUS DOLOMIEUI)*. *Can. J. Zool.* 62(5):951-958. May 1984. In English with French summ. SFA 29(4)
[Duke Power Co., Prod. Environ. Serv., Rt. 4, Box 531, Huntersville, NC 28078]

84-002805 Datta, N. C.; M. K. Das and B. K. Bandyopadhyay. FUNCTIONAL ANATOMY OF THE OLFACTORY APPARATUS OF PUFFER FISH, *SPHAEROIDES OBLONGUS* (BLOCH). *Zool. Pol.* 30(1-4):141-148. 1984. SFA 29(4)
[Fish. Ecol. Res. Unit, Dep. Zool., Univ. Calcutta, Calcutta 700019, India]

84-002806 Dempson, J. B. and R. K. Misra. IDENTIFICATION OF ANADROMOUS ARCTIC CHARR (*SALVELINUS ALPINUS*) STOCKS IN COASTAL AREAS OF NORTHERN LABRADOR BASED ON A MULTIVARIATE STATISTICAL ANALYSIS OF MERISTIC DATA. *Can. J. Zool.* 62(4):631-636. Apr. 1984. In English with French summ. SFA 29(4)
[Dep. Fish. Oceans, P.O. Box 5667, St. John's, NF A1C 5X1, Canada]

84-002807 Derivot, J. H. FUNCTIONAL ANATOMY OF THE PERIPHERAL OLFACTORY SYSTEM OF THE AFRICAN LUNGFISH *PROTOPTERUS ANNECTENS* OWEN: DEVELOPMENT OF THE PRIMARY OLFACTORY PATHWAY DURING POSTEMBRYONIC GROWTH. *Am. J. Anat.* 171(1):15-23. 1984. SFA 29(4)
[Lab. Ecophysiol. Nerv. Endocrin., U.E.R. Sci., 06100 Nice, France]

84-002808 Donnelly, W. A. and L. M. Dill. EVIDENCE FOR CRYPSIS IN COHO SALMON, *ONCORHYNCHUS KISUTCH* (WALBAUM), PARR: SUBSTRATE COLOUR PREFERENCE AND ACHROMATIC REFLECTANCE. *J. Fish Biol.* 25(2):183-195. Aug. 1984. SFA 29(4)
[Dep. Biol. Sci., Simon Fraser Univ., Burnaby, BC V5A 1S6, Canada] The crypsis hypothesis of salmonid parr coloration and behaviour is evaluated in light of the criteria for protective resemblance. A review of the literature indicates that salmonid parr coloration and behaviour correspond to a cryptic interpretation. Experiments on coho salmon, *Oncorhynchus kisutch*, parr substrate colour preference indicate that the behavioural correlate of appropriate background choice is satisfied. Absorption spectrophotometry of diapositives of fish and experimental substrates suggests that background matching is achieved through achromatic reflectance and absorption of wavelengths by the silvery sides and parr marks, respectively.

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84-002809 Dunn-Meynell, A. A. and S. C. Sharma. CHANGES IN THE TOPOGRAPHICALLY ORGANIZED CONNECTIONS BETWEEN THE NUCLEUS ISTHMI AND THE OPTIC TECTUM AFTER PARTIAL TECTAL ABLATION IN ADULT GOLDFISH. *J. Comp. Neurol.* 227(4):497-510. 20 Aug. 1984. SFA 29(4)
[Dep. Ophthalmol., N.Y. Med. Coll., Valhalla, NY 10595]

84-002810 Elger, M.; I. Wahlqvist and H. Hentschel. ULTRASTRUCTURE AND ADRENERGIC INNERVATION OF PREGLOMERULAR ARTERIOLES IN THE EURYHALINE TELEOST, *SALMO GAIRDNERI*. *Cell Tissue Res.* 237(3):451-458. Aug. 1984. SFA 29(4)
[Lab. Electron Micros., Sch. Med., Hannover, West Germany]

84-002811 Ferri, S. and A. C. M. Stipp. ELECTRON-MICROSCOPE OBSERVATIONS ON THE NUCLEAR ENVELOPE-LIMITED MONOLAYERS OF CHROMATIN IN TELEOST (*PIMELODUS MACULATUS*) PANCREATIC ENDOCRINE CELLS. *Zool. Anz.* 213(1-2):106-110. 1984. SFA 29(4)
[Dep. Histol., Inst. Cience. Biomed., Univ. São Paulo, Caixa Postal 4365, 01000 São Paulo, Brazil]

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[CNEXO/COB, BP 337, 29273 Brest Cedex, France] Spring activation of the gill $Na^+$-$K^+$-ATPase, osmotic variations after direct exposure to sea-water of high salinity ($35.5^{\circ}/_{00}$), survival, and growth were studied in three salmonid species reared in France (*Salmo trutta, Salmo gairdneri, Salvelinus fontinalis*) and in the hybrid tiger trout (♀ *S. trutta* X ♂ *S. fontinalis*). The brown trout (*S. trutta*) studied showed physiological characteristics of smolification: increase of the gill enzyme activity in fresh-water, rapid control of the osmotic lack of balance after sea-water contact, good growth and survival in summer. Rainbow trout presented characteristics of sedentary species: low values of the gill $Na^+$-$K^+$-ATPase in fresh-water, and greater and more durable osmotic variations. In spite of a certain degree of euryhalinity in spring and winter, this species suffered significant losses in sea-water during summer. Brook trout appeared as a very stenohaline species unable to survive in sea-water of high salinity; the hybrid presented intermediate characteristics between the two parents. The level of activity of the gill $Na^+$-$K^+$-ATPase in fresh-water, as well as its evolution after sea-water contact appears as a good indicator of the adaptability of the species to a very hyperosmotic environment, and reveals different strategies for regulating the hydromineral balance, which are discussed.

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[PINRO, Murmansk, USSR] Preparation of the osmoregulatory system for functioning in marine waters was observed in smolts of three groups of salmon (Atlantic, Baltic and "landlocked" salmon). In the Baltic and freshwater salmon feeding in a hypotonic medium (brackish or fresh water), restructuring of the osmoregulatory system, analogous to desmoltificational changes

## PHYSIOLOGY (CONTINUED)

84-002888 CONTINUED observed in smolts of Atlantic salmon maintained in fresh water, takes place. There are reports about salmon undergoing desmoltification under natural conditions, and a female Atlantic salmon attained a weight of 1.5 kg and maturation stage III in fresh water. These results indicate that the freshwater and Baltic salmon originated from a typical marine form. The possible origin of intraspecific forms of Atlantic salmon are discussed.

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[Dep. Fish. Wildl. Biol., Colo. State Univ., Fort Collins 80523] A model is developed to predict potential net energy gain for salmonids in streams from characteristics of water velocity and invertebrate drift. Potential net energy gain, or potential profit, is calculated for individuals of three species of juvenile salmonids in a laboratory stream aquarium, based on the energy avaliable from drift minus the cost of swimming to maintain position. The Michaelis-Menten or Monod model is used to describe the relationship between potential profit and specific growth rate. Potential profit was a better predictor of specific growth rate for coho salmon (*Oncorhynchus kisutch*) than for brook trout (*Salvelinus fontinalis*) or brown trout (*Salmo trutta*). Coho salmon always achieved higher specific growth rates than either brook trout or brown trout in concurrent experiments, and maintained growth to lower resource thresholds. In each experiment, fish established intraspecific hierarchies and dominant fish held positions affording maximum potential profit. The use of potential profit as an optimal foraging model was tested by predicting the potential for net energy gain at coho salmon positions from the overall pattern of flow and invertebrate drift in the stream aquarium, and ranking these positions from highest to lowest potential profit. This predicted ranking was nearly identical to the rank observed in the linear dominance hierarchy. The results of experiments confirm ideas of other investigators about mechanisms of microhabitat selection by stream salmonids.

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84-002916 CONTINUED bimodal with peak cortisol values measured at the onset and the offset of light. These thermally induced changes in cortisol hormone patterns may be related to other temperature dependent seasonal changes such as the annual cycle of reproductive development or changes in the time of daily locomotor activity.

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[Dep. Aquacult., Shanghai Fish. Coll., 334 Jung-gong Rd., Shanghai 20090, China] Triploid rainbow trout were produced by hydrostatic pressure applied to eggs 40 min after fertilization. Treatment for 10 min with or without exposure to 2% ether produced high hatching rates. Nuclear measurements from serial section of 40-day-old fry and from blood smears of 5-month-old juveniles showed that the proportion of triploid individuals was 80-90%. Ether treatment alone did not induce triploidy. Attempts to produce tetraploids by hydrostatic pressure treatment of eggs at 8 h after fertilization failed. Parallel results were also obtained with heat shock.

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84-003089 Wooten, M. C. GENETIC AND MORPHOLOGICAL VARIATION IN NATURAL POPULATIONS OF THE RED SHINER, *NOTROPIS LUTRENSIS* AND THEIR RELATIONSHIP TO ADAPTATION IN A GENERALIST SPECIES. *Ph.D. dissertation*, *North Tex. State Univ.* 202p. 1984. From Diss. Abstr. Int. B Sci. Eng. 45(3):769. Sept. 1984. SFA 29(4)

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84-003090 Aoki, I. [INTERNAL DYNAMICS OF FISH SCHOOLS IN RELATION TO INTER-FISH DISTANCE.] *Bull. Jpn. Soc. Sci. Fish.* 50(5):751-758. May 1984. In Japanese with English summ. SFA 29(4)
[Ocean Res. Inst., Univ. Tokyo, Nakano, Tokyo 164, Japan] Movies of schooling of *Gnathopogon elongatus elongatus* and small juvenile *Mugil cephalus* in a tank were analyzed to examine the distance-dependent behavior which is a principle of the organization of fish schools. Dynamic properties were determined in the fluctuation of the nearest neighbor distance by using power spectrum information. Power spectra for the two species had a pattern analogous to each other; the spectral density was greater and flat at the lower frequencies, and decreased approximately in porportion to minus second power of frequency at the higher frequencies.

## BEHAVIOR (CONTINUED)

84-003090 CONTINUED When schools were stable and organized normally, the observed spectra corresponded relatively well to the theoretical results from the assumption of the first order system where a random force was input. Such a property of the fluctuation of the nearest neighbor distance was consistent in spite of the differences in average distances and directions to the nearest neighbor among species and school sizes. In the two-fish school of *Gnathopogon*, however, the value of the time constant was greater than in the eight-fish schools.

84-003091 Bennett, B. A. and C. L. Griffiths. FACTORS AFFECTING THE DISTRIBUTION, ABUNDANCE AND DIVERSITY OF ROCK-POOL FISHES ON THE CAPE PENINSULA, SOUTH AFRICA. *S. Afr. J. Zool.* 19(2):97-104. 1984. SFA 29(4)

[Zool. Dep., Univ. Cape Town, Rondebosch, 7700 South Africa] A quantitative description of the fish communities inhabiting rock pools on the Cape Peninsula, South Africa, and the relationships between the physical characteristics of the pools and the distribution, abundance and diversity of the resident fish fauna are given. A total of 1541 fish, representing 21 species, were collected from 84 rock pools using the ichthyocide Rotenone. The mean density was 7.42 fish $m^{-2}$ (49.60 g $m^{-2}$) of pool area or 0,58 fish $m^{-2}$ (3.67 g $m^{-2}$) of the whole intertidal zone in which the pools were situated. *Clinus superciliosus*, *C. cottoides* and *Chorisochismus dentex* were the most abundant species, together comprising 75% of the biomass and 60% of the number of fish caught. The number of species, number of individuals and biomass of fish in the pools all correlated significantly ( $P < 0.01$) with pool size and the amount of rock cover available. In addition, the number of species decreased up the shore. These three environmental factors in combination accounted for between 58% and 88% of the observed variance in diversity, number and biomass of fish in the pools. Rock cover was the single most important variable, explaining up to 76% of the variance. Possible reasons for the importance of rock cover and its relationship with pool size, are discussed.

84-003092 Bjornn, T. C. and R. R. Ringe. HOMING OF HATCHERY SALMON AND STEELHEAD ALLOWED A SHORT-DISTANCE VOLUNTARY MIGRATION BEFORE TRANSPORT TO THE LOWER COLUMBIA RIVER. *Idaho Coop. Fish. Res. Unit Tech. Rep.* 84-1. iv + 27p. Jan. 1984. SFA 29(4)

[Idaho Coop. Fish. Res. Unit, Univ. Idaho, Moscow 83843]

84-003093 Brannon, E. L.; R. P. Whitman and T. P. Quinn. RESPONSES OF RETURNING ADULT COHO SALMON TO HOME WATER AND POPULATION-SPECIFIC ODORS. *Trans. Am. Fish. Soc.* 113(3):374-377. May 1984. SFA 29(4)

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84-003094 Chapman, C. A. and W. C. Mackay. VERSATILITY IN HABITAT USE BY A TOP AQUATIC PREDATOR, *ESOX LUCIUS* L. *J. Fish Biol.* 25(1):109-115. July 1984. SFA 29(4)

[Dep. Zool., Univ. Alberta, Edmonton, AB, Canada] The habitat selected by northern pike, *Esox lucius*, a solitary top aquatic predator, was evaluated using radio location and ultrasonic telemetry. These predators moved extensively throughout the lake and exhibited a distinct preference for shallow vegetated areas close to shore. Selection of habitat was significantly influenced by meteorological factors. On windy days pike chose habitats which were further from shore, but not necessarily deeper, than those chosen on calm days. On sunny days pike moved in habitats that were close to shore and relatively shallow. Habitat selection of pike was not

BEHAVIOR (CONTINUED)

84-003094 CONTINUED significantly influenced by rain. Northern pike exhibited a much greater versatility in the range of habitats they utilized than was previously believed. We propose that such versatility is an important feature of the behaviour of top predators.

84-003095 Collette, B. B. and C. E. Nauen. FAO SPECIES CATALOGUE VOL. 2 SCOMBRIDS OF THE WORLD. AN ANNOTATED AND ILLUSTRATED CATALOGUE OF TUNAS, MACKERELS, BONITOS AND RELATED SPECIES KNOWN TO DATE. *FAO Fish. Synop.* No. 125. vii + 137p. 1983. SFA 29(4)
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84-003096 Donaldson, K. M. THE EFFECTS OF SIGHT IMPAIRMENT ON THE GOLDFISH (*CARASSIUS AURATUS*). *Bull. S.C. Acad. Sci.* 46:43-44. 1984. Abstract only. SFA 29(4)

84-003097 Dunstall, T. G. DISTRIBUTION OF RAINBOW SMELT AND ALEWIFE LARVAE ALONG THE NORTH SHORE OF LAKE ONTARIO. *J. Great Lakes Res.* 10(3):273-279. 1984. SFA 29(4)
[Ontario Hydro Res. Div., 800 Kipling Ave., Toronto, ON M8Z 5S4, Canada] Distribution and abundance of pelagic larval fish were determined for 12 sites on the north shore of Lake Ontario between Pickering and Wellington. Alewife (*Alosa pseudoharengus*) and rainbow smelt (*Osmerus mordax*) larvae represented over 99.9% of the total catch in the nearshore zone between the 3- and 13-m depth contours. Yolk-sac alewife and rainbow smelt larvae were widespread, while most post-yolk-sac alewife larvae occurred in sheltered waters east of Colborne; developing alewife larvae moved away from shore in upper water strata. Rainbow smelt larvae were concentrated in surface waters shortly after hatching, with a subsequent rapid decline in abundance as larvae moved away from shore to deeper strata.

84-003098 Engaña, A. C. and J. E. McCosker. ATTACKS ON DIVERS BY WHITE SHARKS IN CHILE. *Calif. Fish Game* 70(3):173-179. July 1984. SFA 29(4)
[Univ. de Norte, Coquimbo, Chile] Three attacks upon divers in Chile are reported, analyzed, and illustrated. Attacks at El Panul on 29 September 1963 and Pichidangui on 5 January 1980 were fatal and probably caused by the white shark, *Carcharodon carcharias*. The third, a non-fatal attack, was at Totoralillo and probably caused by a white shark or mako shark, *Isurus oxyrinchus*. Shark attack and diver behavior are comapred to those in North America. Suggestions concerning diver safety are presented.

84-003099 Eriksson, T. ADJUSTMENTS IN ANNUAL CYCLES OF SWIMMING BHEAVIOUR IN JUVENILE BALTIC SALMON IN FRESH AND BRACKISH WATER. *Trans. Am. Fish. Soc.* 113(4):467-471. July 1984. SFA 29(4)
[Dep. Ecol. Zool., Univ. Umeå, S-901 87 Umeå, Sweden]

84-003100 Fay, R. R. THE GOLDFISH EAR CODES THE AXIS OF ACOUSTIC PARTICLE MOTION IN THREE DIMENSIONS. *Science* 225(4665):951-954. 31 Aug. 1984. SFA 29(4)
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84-003103 Gleyzer, S. I. POSSIBILITY OF COLOR ADAPTATION OF FISH VISION. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(6):162-164. 1983. SFA 29(4)
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84-003104 Godin, J. J. TEMPROAL VARIATIONS IN DAILY PATTERNS OF SWIMMING ACTIVITY AND VERTICAL DISTRIBUTION IN JUVENILE PINK SALMON (*ONCORHYNCHUS GORBUSCHA*). *Can. J. Zool.* 62(1):72-79. Jan. 1984. In English with French summ. SFA 29(4)
[Dep. Biol., Mount Allison Univ., Sackville, NB EOA 3CO, Canada] At times corresponding to their juvenile coastal and pelagic ocean phases, groups of juvenile pink salmon exhibited diet rhythms of generally diurnal swimming activity and nocturnal vertical movement in response to simulated seasonal variations in photoperiod and water temperature in the laboratory. Diurnal swimming activity was synchronized with the daily light cycle throughout most of the year, but not with ambient daily temperature cycles. On average, fish were increasingly more active during the day than at night with increasing duration of the photophase. Relative swimming speed also increased with increasing photophase duration, and was not affected by seasonal changes in temperature. The fish always showed a greater tendency to swim in the upper half of the water column during the night than during the day. This rhythm of vertical distribution was more strongly synchronized with the daily light cycle in winter than during any other season. Daily temperature cycles did not synchronize these distribution patterns. No significant seasonal trend was noted in mean levels or mean indices of vertical distribution. Results are related to the migratory behaviour of pink salmon, and it is concluded that photoperiod may be an important proximate factor in the timing of their seasonal migratory behaviour.

84-003105 Gorlick, D. L. PREFERENCE FOR ECTOPARASITE-INFECTED HOST FISHES BY THE HAWAIIAN CLEANING WRASSE, *LABROIDES PHTHIROPHAGUS* (LABRIDAE). *Copeia* 1984(3):758-762. 1 Aug. 1984. SFA 29(4)
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[I.M. Sechenov Inst. Evol. Physiol. Biochem., Thorez Prospect 44, 194223 Lenningrad, USSR]

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84-003107 Gregg, K. W. DESCRIPTION OF A TEST CHAMBER FOR QUANTITATIVE STUDY OF FISH BEHAVIOR. *Bull. S.C. Acad. Sci.* 46:95. 1984. Abstract only. SFA 29(4)

84-003108 Hallacher, L. E. RELOCATION OF ORIGINAL TERRITORIES BY DISPLACED BLACK-AND-YELLOW ROCKFISH, *SEBASTES CHRYSOMELAS*, FROM CARMEL BAY, CALIFORNIA. *Calif. Fish Game* 70(3):158-162. July 1984. SFA 29(4)

[Biol. Discipline, Nat. Sci. Div., Univ. Hawaii, Hilo 96720] The black-and-yellow rockfish, *Sebastes chrysomelas*, is a perennially territorial species that normally exhibits limited movement away from its territory. A total of thirty individuals were transported away from their territories during four translocation esperiments. A high percentage (66%-71%) of fish returned to the site of capture within two weeks, from distances up to 50 meters. Fish moved 1.5 kilometers from their territories did not return, even after 4 months. Sensory parameters used by this species for territory relocation are unknown. Homing behavior in a normally sedentary species seems paradoxical, and this species may be more mobile than previously thought.

84-003109 Hanson, M.; G. Wirmark; M. Öblad and L. Strid. IRON-RICH PARTICLES IN EUROPEAN EEL (*ANGUILLA ANGUILLA* L.). *Comp. Biochem. Physiol. A Comp. Physiol.* 79(2):311-316. 1984. SFA 29(4)

[Dep. Phys., Chalmers Univ. Technol., S-412 96 Gothenburg, Sweden]

84-003110 Helfman, G. S. SCHOOL FIDELITY IN FISHES: THE YELLOW PERCH PATTERN. *Anim. Behav.* 32(3):663-672. Aug. 1984. SFA 29(4)

[Dep. Zool., Univ., Ga., Athens 30602] School fidelity concerns the cohesiveness of social aggregations over time, as measured by the regularity or repeatability with which known individuals re-occur as members of a school. School fidelity was measured by divers who observed yellow perch (*Perca flavescens*) marked with individually recognizable tags in Cazenovia Lake, New York. Yellow perch were facultative schoolers, with individual differences in schooling tendency (measured as percentage of time in schools) accounting for different numbers of observations of schooled versus solitary fish. the greatest co-occurrence was found between fish with strong schooling tendencies, but within this group co-occurrence was random. Home ranges overlapped greatly between individuals, yet co-occurrence was more a function of schooling tendency than of overlapping home ranges. Individuals with overlapping home ranges but with weak schooling tendencies seldom co-occurred. Home range size increased directly with schooling tendency: the distances that individuals moved apparently depended on the movements of the schools they joined, with strongly schooling fish remaining in shcools longer. Individuals joined and left shcools frequently; this also reflects a lack of fidelity between fish. Fish schools that form primarily for predator avoidance may show higher levels of fidelity than do schools that form for foraging or hydrodynamic efficiency.

84-003111 Hiraishi, T.; K. Yamamoto; K. Nashimoto and O. Sato. [BODY FORM OF RAINBOW TROUT SWIMMING IN THE STEADY FLOW.] *Bull. Jpn. Soc. Sci. Fish.* 50(6):951-958. June 1984. In Japanese with English summ. SFA 29(4)

[Fac. Fish., Hokkaido Univ., Minato, Hakodate 041, Japan]

84-003112 Jackson, D. C. SUBSTRATE PREFERENCE OF THE BIGSCALE LOGPERCH, *PERCINA MACROLEPIDA* (PERCIDAE) IN LAKE TEXOMA OKLAHOMA. *Southwest. Nat.* 29(3):351-353. 28 Aug. 1984. SFA 29(4)

[Dep. Fish. Allied Aquacult., Auburn Univ., Auburn, AL 36849]

BEHAVIOR (CONTINUED)

84-003113 Jones, K. A. TEMPERATURE DEPENDENT ATTRACTION BY GOLDFISH TO A CHEMICAL FEEDING CUE PRESENTED ALONE AND IN COMBINATION WITH HEATED WATER. *Physiol. Behav.* 33(4):509-515. Oct. 1984. SFA 29(4)
[P.O. Box 4108, Florence, SC 29503]

84-003114 Koyama, Y. and K. Ueda. [THE OPTOKINETIC RESPONSE OF THE RAINBOW TROUT *SALMO GAIRDNERI*.] *Bull. Jpn. Soc. Sci. Fish.* 50(6):943-950. June 1984. In Japanese with English summ. SFA 29(4)
[Zool. Inst., Fac. Sci., Univ. Tokyo, Bunkyo, Tokyo 113, Japan]

84-003115 McCabe, G. T., Jr.; W. D. Muir; R. L. Emmett and J. T. Durkin. INTERRELATIONSHIPS BETWEEN JUVENILE SALMONIDS AND NONSALMONID FISH IN THE COLUMBIA RIVER ESTUARY. *NOAA Fish. Bull.* 81(4):815-826. Oct. 1983. SFA 29(4)
[NMFS, 2725 Moutlake Blvd. East, Seattle, WA 98112]

84-003116 Miller, D. L. A MULTIVARIATE ASSESSMENT OF SEASONAL NICHE RELATIONSHIPS IN A LOTIC FISH COMMUNITY. *Bull. Ecol. Soc. Am.* 65(2):132. June 1984. Abstract only. SFA 29(4)
[Colo. State Univ., Fort Collins 85023]

84-003117 Montgomery, J. C. and J. A. Macdonald. PERFORMANCE OF MOTOR SYSTEMS IN ANTARCTIC FISHES. *J. Comp. Physiol. A Sens. Neural Behav. Physiol.* 154(2):241-248. Feb. 1984. SFA 29(4)
[Dep. Zool., Univ. Auckland, P.B., Auckland, New Zealand]

84-003118 Probst, W. E.; C. F. Rabeni; W. G. Covington and R. E. Marteney. RESOURCE USE BY STREAM-DWELLING ROCK BASS AND SMALLMOUTH BASS. *S. Afr. J. Zool.* 19(2):283-294. Apr. 1984. SFA 29(4)
[Ga. Dep. Nat. Resour., Fish. Sect., Rt. 2, Box 219 R, Richmond Hill 31324]

84-003119 Quinn, T. P. and C. Groot. PACIFIC SALMON (*ONCORHYNCHUS*) MIGRATIONS: ORIENTATION VERSUS RANDOM MOVEMENT. *Can. J. Fish. Aquatic Sci.* 41(9):1319-1324. Sept. 1984. In English with French summ. SFA 29(4)
[Fish. Res. Br., Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

84-003120 Quinn, T. P. and K. Fresh. HOMING AND STRAYING IN CHINOOK SALMON (*ONCORHYNCHUS TSHAWYTSCHA*) FROM COWLITZ RIVER HATCHERY, WASHINGTON. *Can. J. Fish. Aquatic Sci.* 41(7):1078-1082. July 1984. In English with French summ. SFA 29(4)
[Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

84-003121 Ribbink, A. J. THE FEEDING BEHAVIOUR OF A CLEANER AND SCALE, SKIN AND FIN EATER FROM LAKE MALAWI (*DOCIMODUS EVELYNAE*; PISCES, CICHLIDAE). *Neth. J. Zool.* 34(2):182-196. Aug. 1984. SFA 29(4)
[J.L.B. Smith Inst. Ichthyol., P.B. 1015, Grahamstown, 6140 South Africa]

84-003122 Robertson, D. R. COHABITATION OF COMPETING TERRITORIAL DAMSELFISHES ON A CARIBBEAN CORAL REEF. *NOAA Fish. Bull.* 81(4):1121-1135. Aug. 1984. SFA 29(4)
[Smithsonian Trop. Res. Inst., Apt. 2072, Balboa, Panama]

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84-003123 Schlagenhaft, T. W. and B. R. Murphy. SPATIAL INTERACTIONS OF COHABITING PREDATORY FISH SPECIES. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 6:26. 1984. Abstract only. SFA 29(4)
[Dep. Range Wildl. Manage., Tex. Tech. Univ., Lubbock 79409]

84-003124 Schut, J.; S. S. DeSilva and K. Kortmulder. HABITAT, ASSOCIATIONS AND COMPETITION OF EIGHT *BARBUS* (= *PUNTIUS*) SPECIES (PISCES, CYRINIDAE) INDIGENOUS TO SRI LANKA. *Neth. J. Zool.* 34(2):159-181. Aug. 1984. SFA 29(4)
[Zool. Lab., Univ. Leiden, Postbus 9516, 2300 RA Leiden, Netherlands]

84-003125 Schwarz, A. L. and G. L. Greer. RESPONSES OF PACIFIC HERRING, *CLUPEA HARENGUS PALLASI*, TO SOME UNDERWATER SOUNDS. *Can. J. Fish. Aquatic Sci.* 41(8):1183-1192. Aug. 1984. In English with French summ. SFA 29(4)
[Dep. Fish. Oceans, West Vancouver Lab., 4160 Marine Drive, West Vancouver, BC V7V 1N6, Canada]

84-003126 Shields, M. A. and C. H. Mayes. OCCURRENCE AND HABITAT PREFERENCE OF *FUNDULUS LUCIAE* (BAIRD) (PISCES: CYPRINODONTIDAE) ON A SOUTHEASTERN NORTH CAROLINA SALT MARSH. *Brimleyana* No. 9. p. 141-144. June 1983. SFA 29(4)
[Dep. Biol. Sci., Univ. N.C., Wilmington 28403] Thirty-two *Fundulus luciae* were collected in pit traps on a salt marsh in southeastern North Carolina during October and November 1983. This species remained on the marsh at low tide, exhibiting a strong preference for high marsh areas dominated by *Juncus roemerianus* while tending to avoid low marsh habitats dominated by *Spartina alterniflora*. The reported rarity of *F. luciae* probably reflects inadequate sampling of its preferred high marsh habitat by conventional collecting technqiues.

84-003127 Stabell, O. B. HOMING AND OLFACTION IN SALMONIDS: A CRITICAL REVIEW WITH SPECIAL REFERENCE TO THE ATLANTIC SALMON. *Biol. Rev. Cambridge Philos. Soc.* 59(3):333-388. Aug. 1984. SFA 29(4)
[Inst. Zoophysiol., Univ. Oslo, Blindern, Oslo 3, Norway]

84-003128 Tsvetkov, V. I. and Y. N. Sbikin. PECULIARITIES OF HYDROSTATICS OF BELUGA, *HUSO HUSO* (ACIPENSERIDAE), FINGERLINGS AND THEIR DISTRIBUTION IN VERTICAL SALINITY GRADIENTS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(6):112-119. 1983. SFA 29(4)
[IEMEZH, Moscow, USSR]

84-003129 Van der Meer, H. J. and G. C. Anker. RETINAL RESOLVING POWER AND SENSITIVITY OF THE PHOTOPIC SYSTEM IN SEVEN HAPLOCHROMINE SPECIES (TELEOSTEI, CICHLIDAE). *Neth. J. Zool.* 34(2):197-209. Aug. 1984. SFA 29(4)
[Zool. Lab., Univ. Leiden, P.B. 9516, 2300 RA Leiden, Netherlands]

84-003130 Walker, M. M. STUDIES OF MAGNETIC SENSITIVITY IN THE YELLOWFIN TUNA, *THUNNUS ALBACARES* Ph.D. dissertation, Univ. Hawaii. 278p. 1983. From Diss. Abstr. Int. B. Sci. Eng. 45(1):92. July 1984. SFA 29(4)

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84-003131 Whitman, P. TONIC IMMOBILITY OR "DEATH FEIGNING" IN THE BLUEGILL, *LEPOMIS MACROCHIRUS* RAFINESQUE. *Proc. W. Va. Acad. Sci.* 53(1):4. 1981. Abstract only. SFA 29(4)
[Dep. Biol., W. Va. Univ., Morganstown 26505]

## LIFE HISTORY-GENERAL WORKS

84-003132 Anderson, J. T. EARLY LIFE HISTORY OF REDFISH (*SEBASTES* SPP.) ON FLEMISH CAP. *Can. J. Fish. Aquatic Sci.* 41(7):1106-1116. July 1984. In English with French summ. SFA 29(4)
[Dep. Fish. Oceans, P.O. Box 5667, St. John's, NF A1C 5X1, Canada]

84-003133 Bugaev, V. F. and V. I. Karpenko. SOME DATA ON MIGRATION AND FEEDING OF UNDERYEARLING SOCKEYE SALMON, *ONCORHYNCHUS NERKA* (SALMONIDAE), AT THE MOUTH OF THE KAMCHATKA RIVER. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(6):146-150. 1983. SFA 29(4)
[KoTINRO, Petropavlovsk-Kamchatskiy, USSR]

84-003134 Gajdůsek, J. MORFOLOGIE, RŮST, ROZMNOZOVÁNÍ, VYVOJ A PRODUKCE CEJINA VELKÉHO *(ABRIMIS BRAMA L)*. [MORPHOLOGY, GROWTH, REPRODUCTION, DEVELOPMENT AND PRODUCTION IN THE BREAM (*ABRAMIS BRAMA* L.). *Vertebr. Zpravy* 1983:44-45. 1983. In Czeck. SFA 29(4)

84-003135 Harris, J. H. THE AUSTRALIAN BASS, *MACQUARIA NOVEMACULEATA. Ph.D. dissertation, Univ. New South Wales* 1984. From Diss. Abstr. Int. B Sci. Eng. 45(3):794. Sept. 1984. SFA 29(4) The research project reported in this thesis investigated the biology of the Australian bass, *Macquaria novemaculeata* (Perciformes: Percichthyidae), a catadromous fish of south-eastern Australia. Bass populations were studied at sites representing main habitats in the Hawkesbury River system and the Sydney Basin, between November 1977 and January 1982. Aspects examined were age and growth, reproduction, diet, demography (including abundance, mortality, production, and population trends), and migration. Sampling methods included gill-netting, trapping, angling and dip-netting. A variety of standard and innovative experimental, laboratory and analytical techniques were used; data analysis was facilitated by computer. Stream impoundments in the range of bass were also studied in relation to fish migration and fish passage facilities. General results from 1071 adults and 7,546 young fish showed that *M. novemaculeata* is a long-lived, slow-growing species. Males are smaller than females, and habitat type controls growth. Spawning occurs between late June and early September in the brackish estuarine zone, and is dependent on flooding. Spawning is serial and highly fecund, and eggs are demersal. If flooding does not occur, females remain in fresh water, and ovaries commence involution in September. Females make precise return homing migration after spawning. Larvae recruit to macrophyte beds, and migrate upstream during spring and summer. Populations are sexually segregated; few male juveniles progress above tidal limit. Individual adult bass are sparsely distributed in littoral areas. They are generally solitary, cryptic and crepuscular, with an extensive home range. The diet is carnivorous and generalized, with marked seasonal and habitat variation. Production of adults in a lagoon was low, and P/B ratio was exceptionally low. Detrimental changes in bass populations were related to human activities. Recruitment showed a long-term decline, and was correlated with winter stream flow, which is suppressed by dams. Declining mean length and age in Hawkesbury fish indicated an increasing mortality rate between 1977 and 1982. Impoundments obstructed access to about half the potentially

LIFE HISTORY-GENERAL WORKS (CONTINUED)

84-003135 CONTINUED available habitat throughout the range of bass, and the few fishways were rarely effective.

84-003136 Horn, M. H.; L. G. Allen and F. D. Hagner. ECOLOGICAL STATUS OF STRIPED BASS, *MORONE SAXATILIS*, IN UPPER NEW PORT BAY, CALIFORNIA. *Calif. Fish Game* 70(3):180-192. July 1984. SFA 29(4)
[Dep. Biol. Sci., Calif. State Univ., Fullerton 92634]

84-003137 Hughes, G. W. and A. E. Peden. LIFE HISTORY AND STATUS OF THE SHORTHEAD SCULPIN (*COTTUS CONFUSUS*: PISCES, COTTIDAE) IN CANADA AND THE SYMPATRIC RELATIONSHIP TO THE SLIMY SCULPIN (*COTTUS COGNATUS*). *Can. J. Zool.* 62(2):306-311. Feb. 1984. In English with French summ. SFA 29(4)
[Aquatic Zool. Div., British Columbia Prov. Mus., 675 Belleville St., Victoria, BC V8V 1X4, Canada]

84-003138 Maitland, P. S.; K. H. Morris; K. East; M. P. Schoonoord; B. Van der Wal and I. C. Potter. THE ESTUARINE BIOLOGY OF THE RIVER LAMPREY, *LAMPETRA FLUVIATILIS*, IN THE FIRTH OF FORTH, SCOTLAND, WITH PARTICULAR REFERENCE TO SIZE COMPOSITION AND FEEDING. *J. Zool. (Lond)* 203(2):211-225. June 1984. SFA 29(4)
[Inst. Terres. Ecol., 78 Craighall Rd., Edinburgh, Scotland]

84-003139 Moore, C. M. and R. F. Labisky. POPULATION PARAMETERS OF A RELATIVELY UNEXPLOITED STOCK OF SNOWY GROUPER IN THE LOWER FLORIDA KEYS. *Trans. Am. Fish. Soc.* 113(3):322-329. May 1984. SFA 29(4)
[Dep. Fish. Wildl. Sci., VPI & SU, Blacksburg, VA 24061]

84-003140 Nash, R. D. M. ASPECTS OF THE BIOLOGY OF THE BLACK GOBY, *GOBIUS NIGER L.*, IN OSLOFJORDEN, NORWAY. *Sarsia* 69(1):55-61. 1984. SFA 29(4)
[Cent. Limnol., Univ. Wis., Madison 53706] A population of black gobies was sampled from a small bay in the inner Oslofjord from August 1981 -September 1982. In the beach area, water temperature ranged from 19.8 °C to ice cover, salinity between 26.6 and 20.4 $^{o}/oo$, and dissolved oxygen between 11.2 and 3.3 ml $O_2/l$. The spawning season was from May to July. Maximum abundance of *G. niger* was in June-July just prior to maximum water temperatures. Recruitment of the new year class to the beach area occurred around September. The 1981 year class was relatively poor whereas the 1980 year class was strong. The maximum age observed was 5+ years. Von Bertalanffy growth curves for males and females indicated that males grow more slowly ($k = 0.398$) but reach a greater maximum theoretical length ($L_\infty = 9.774$) than females ($k = 0.479$, $L_\infty = 9.123$). When compared to length at capture data, the back-calculated lengths gave von Bertalanffy equations with the greater growth rates and lower maximum theoretical lengths for both males and females ($k = 0.698$, $L_\infty = 8.641$ and $k = 0.592$, $L_\infty = 8.452$ respectively). On average, growth continued throughout the life span. Size-selective mortality was indicated for males of this species. Overall, the sex ratio was 1:1 except during the spawning season when there was a preponderance of females. There were no behavioural differences over diel cycles in the catchability of males and females.

84-003141 Pflug, D. E. and G. B. Pauley. BIOLOGY OF SMALLMOUTH BASS (*MICROPTERUS DOLOMIEUI*) IN LAKE SAMMAMISH, WASHINGTON. *Northwest Sci.* 58(2):118-130. May 1984. SFA 29(4)

LIFE HISTORY-GENERAL WORKS (CONTINUED)

84-003141 CONTINUED

[R.W. Beck & Assoc., Tower Bldg., Seventh and Olive Way, Seatle, WA 98101] Smallmouth bass (*Micropterus dolomieui*) grew vary rapidly in Lake Sammamish, with mean averages of 10.1 cm (1-year), 18.5 cm (2-year), 26.0 cm (3-year), 31.4 cm (4-year), 35.7 cm (5-year), 38.3 cm (6-year) and 41.4 cm (7-year). Most of the fish were 2- and 3-year-old bass, representing 39 and 24 percent of the total population respectively. Incremental growth was greatest between the ages of 1 and 3 and progressively decreased between the ages of 4 and 7. The growth rate exceeds that observed in most other North American waters. While crayfish (*Pasifastacus leniusculus*) and sculpins (*Cottus* sp.) made up a major part of the diet in most months, migratory salmon (*Oncorhynchus* sp.) were the most important prey item in the month of May, at the peak of the salmonid outmigration. Evidence is presented to support the theory that smallmouth bass do not selectively feed on salmon but are random feeders, eating whatever prey item is available. A regression line plot of prey length versus smallmouth bass size showed a positive correlation between prey size and predator size. The preferred habitat of the smallmouth bass was characterized by a hard substrate combined with a dropoff from an overbank and the absence of aquatic vegetation.

84-003142 Richter, H. *NOTHOBRANCHIUS JUBBI* - A GIANT IN A COLORFUL CLAN. *Trop. Fish Hobbyist* 33(2):28-34. Oct. 1984. SFA 29(4)

84-003143 Roff, D. A. THE EVOLUTION OF LIFE HISTORY PARAMETERS IN TELEOSTS. *Can. J. Fish. Aquatic Sci.* 41(6):989-1000. June 1984. In English with French summ. SFA 29(4)

[Dep. Biol., McGill Univ., 1205 Ave. Docteur Penfield, Montreal, PQ H3A 1B1, Canada]

84-003144 Sloane, R. D. DISTRIBUTION, ABUNDANCE, GROWTH AND FOOD OF FRESHWATER EELS (*ANGUILLA* SPP.) IN THE DOUGLAS RIVER, TASMANIA. *Aust. J. Mar. Freshwater Res.* 35(3):325-339. 1984. SFA 29(4)

[Inland Fish. Comm., 127 Davey St., Hobart, Tas. 7000, Australia]

84-003145 Stevens, J. D. LIFE-HISTORY AND ECOLOGY OF SHARKS AT ALDABRA ATOLL, INDIAN OCEAN. *Proc. R. Soc. Lond. B Biol. Sci.* 222(1226):79-106. 23 July 1984. SFA 29(4)

[Mar. Biol. Assoc., Citadell Hill, Plymouth PL1 2PB, England]

84-003146 Tyus, H. M. and C. W. McAda. MIGRATION, MOVEMENTS AND HABITAT PREFERENCES OF COLORADO SQUAWFISH, *PTYCHOCHEILUS LUCIUS*, IN THE GREEN, WHITE AND YAMPA RIVERS, COLORADO AND UTAH. *Southwest. Nat.* 29(3):289-299. 28 Aug. 1984. SFA 29(4)

[U.S. FWS, Colo. River Fish. Proj., 447 E. Main St., Vernal, UT 84078] A total of 31 Colorado squawfish, *Ptychocheilus lucius*, were collected from the Green River in 1980 and the Green, White and Yampa rivers in 1981. The fish were surgically implanted with radiotransmitter modules and their movement monitored for up to five months each year. Two movement patterns were linked to fish maturity: mature fish were highly mobile; immature fish were sedentary. A spawning migration of up to 205 km one-way was documented in 1981. Fish migrated upstream and downstream to reach a common spawning ground in the lower Yampa River canyon. Diel studies indicated no diel rhythmn in movement existed until after spawning, when the fish were more active from 0800-1200 h. Colorado squawfish were monitored primarily in

## LIFE HISTORY-GENERAL WORKS (CONTINUED)

84-003146 CONTINUED shoreline habitat over sand substrates. There were significant differences recorded for water depths and velocities selected by Colorado squawfish between the Green, White and Yampa rivers, but no difference occurred between 1980 and 1981 values recorded in the Green River.

## POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC.

84-003147 Bailey, R. S. and E. J. Simmonds. ACOUSTIC SURVEYS FOR HERRING IN THE ORKNEY-SHETLAND AREA. *Scott. Fish. Bull.* 48:30-36. 1984. SFA 29(4)
[Mar. Lab., P.O. Box 101, Victoria Rd., Aberdeen AB9 8DB, Scotland]

84-003148 Bedenbaugh, R. L.; R. S. Birdsong and R. D. Owen. ANALYSIS OF THE CATCH FROM A POINT NET NEAR CAPE HENRY FOR THE TEN YEAR PERIOD 1973-1982. *Va. J. Sci.* 35(2):113. 1984. Abstract only. SFA 29(4)
[Dep. Biol. Sci., Old Dominion Univ., Norfold, VA 23508]

84-003149 Borgmann, U.; H. Shear and J. Moore. ZOOPLANKTON AND POTENTIAL FISH PRODUCTION IN LAKE ONTARIO. *Can. J. Fish. Aquatic Sci.* 41(9):1303-1309. Sept. 1984. In English with French summ. SFA 29(4)
[Dep. Fish. Oceans, Can. Cent. Inland Waters, Burlington, ON L7R 4A6, Canada]

84-003150 Brenner, B. C. and R. L. Noble. INDICES OF POPULATION SIZE AND SIZE STRUCTURE OF LARGEMOUTH BASS. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 6:20. 1984. Abstract only. SFA 29(4)
[Dep. Wildl. Fish. Sci., Tex A&M Univ., College Station 77843] Population estimates were obtained for largemouth bass *Micropterus salmoides* in 11 flood prevention lakes by mark-recapture. Three estimates were obtained for each lake over a 15-month period (Fall, 1979; Spring, 1980; Fall, 1980). Best estimates ranged from 35 to 1,310 bass < 250 mm TL per hectare and 6 to 107 bass > 250 mm TL per hectare. Relative abundance of the two size groups was represented better by spring than by fall electrofishing. Proportional stock density values of 40 to 60% corresponded to highest bass biomasses. Gill nets poorly represented bass abundance and size distribution.

84-003151 Craig, J. F. and J. M. Fletcher. GROWTH AND MORTALITY OF ZEBRA FISH, *BRACHYDANIO RERIO* (HAMILTON BUCHANAN), MAINTAINED AT TWO TEMPERATURES AND ON TWO DIETS. *J. Fish Biol.* 25(1):43-55. July 1984. SFA 29(4)
[Alberta Environ. Cent., Bag 4000, Vegreville, AB T0B 4L0, Canada]

84-003152 Edwards, J. I. and D. W. McKay. SPRAT ACOUSTIC SURVEYS. *Scott. Fish. Bull.* 48:36-40. 1984. SFA 29(4)
[Mar. Lab., P.O. Box 101, Victoria Rd., Aberdeen AB9 8DB, Scotland]

84-003153 Elliott, J. M. GROWTH, SIZE, BIOMASS AND PRODUCTION OF YOUNG MIGRATORY TROUT *SALMO TRUTTA* IN A LAKE DISTRICT STREAM, 1966-83. *J. Anim. Ecol.* 53(3):979-994. Oct. 1984. SFA 29(4)
[Freshwater Biol. Assoc., Windermere Lab., Ambleside, Cumbria, England]

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

84-003154 Erman, D. C. LONG-TERM TRENDS OF FISH POPULATIONS IN A SECOND ORDER SIERRAN STREAM, SAGEHEN CREEK. *Bull. Ecol. Soc. Am.* 65(2):128. June 1984. Abstract only. SFA 29(4)
[Univ. Calif., Berkeley]

84-003155 Forbes, S. T. and J. R. Hutcheon. ACOUSTIC SURVEYS FOR BLUE WHITING. *Scott. Fish. Bull.* 48:40-43. 1984. SFA 29(4)
[Mar. Lab., P.O. Box 101, Victoria Rd., Aberdeen AB9 8DB, Scotland]

84-003156 Hirst, S. M. ECOLOGICAL AND INSTITUTIONAL BASES FOR LONG-TERM MONITORING OF FISH AND WILDLIFE POPULATIONS. *In: J. F. Bell and T. Atterbury, eds. Renewable Resource Inventories for Monitoring Changes and Trends. Proceedings of an International Conference.* p. 175-178. Dec. 1983. SFA 29(4)
[British Columbia Hydro Power Auth., 555 West Hastings St., Vancouver, BC V6B 4T6, Canada]

84-003157 Hubbs, C. CHANGES IN FISH ABUNDANCE WITH TIME OF DAY AND AMONG YEARS AT A STATION IN LAKE TEXOMA. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 6:42-57. 1984. Abstract only. SFA 29(4)
[Dep. Zool., Univ. Tex., Austin 78712]

84-003158 Jones, A. R. and D. E. Stephens. MUSKALLUNGE STREAMS INVESTIGATION IN THE SOUTH FORK KENTUCKY RIVER DRAINAGE. *Ky. Dep. Fish Wildl. Resour. Fish. Bull.* No. 71. 52p. Sept. 1984. SFA 29(4)

84-003159 Methot, R. D., Jr. SEASONAL VARIATION IN SURVIVAL OF LARVAL NORTHERN ANCHOVY, *ENGRAULIS MORDAX*, ESTIMATED FROM THE AGE DISTRIBUTION OF JUVENILES. NOAA *Fish. Bull.* 81(4):741-750. Oct. 1983. SFA 29(4)
[NMFS, 8604 La Jolla Shores Dr., La Jolla, CA 92038]

84-003160 Miranda, L. E. AVERAGE ICHTHYOMASSES IN TEXAS LARGE IMPOUNDMENTS. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 6:58-67. 1984. SFA 29(4)
[Miss. Coop. Fish. Wildl. Unit, P.O. Drawer BX, Mississippi State 39762]
Quantitative ichthyomass estimates from 111 Texas large impoundments (> 500 acres) were summarized by ecological regions and statewide. Data were obtained from 1974 through 1982 using standardized cove rotenone sampling techniques. Statewide, the mean total ichthyomass was 240.5 lb/acre and the most abundant fishes were gizzard shad *Dorosoma cepediamum cepediamum* (69.2 lb/acre), common carp *Cyprinus carpio* and goldfish *Carassius auratus* (48.8 lb/acre), sunfishes *Lepomis* spp. (38.7 lb/ acre), black basses *Micropterus* spp. (18.8 lb/acre), and catfishes *Ictalurus furcatus* and *I. punctatus* (16.4 lb/acre). When present, tilapia *Tilapia* spp. (51.5 lb/acre), buffalofishes *Ictiobus* spp. (32.4 lb/acre) and freshwater drum *Aplodinotus grunniens* (20.3 lb/acre) usually contributed a large portion of the total ichthyomass. Ichthyomasses as well as percent composition varied among regions. These summaries provide reservoir managers with standards for comparative purposes.

84-003161 Muzík, V. ABUNDANCIA, ICHTYOMASA, RAST A VEKOVÁ STRUKTÚRA RYBEJ OBSÁDKY POTOKA PAPRADNIANKA. [ABUNDANCE, ICHTHYOMASS, GROWTH AND AGE STRUCTURE OF THE FISH FRY IN THE PAPRADNIANKA BROOK.] *Biologia* (Bratisl.) 39(6):599-610. 1984. In Czech with English summ. SFA 29(4)
[Slovensky Rybársky Zväz, Krajsky vybor, Ruttkaya-Nedeckého 2 974 00 Banská Bystrica, Czechoslovakia]

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

84-003162 Sano, M.; M. Shimizu and Y. Nose. CHANGES IN STRUCTURE OF CORAL REEF FISH COMMUNITIES BY DESTRUCTION OF HERMATYPIC CORALS: OBSERVATIONAL AND EXPERIMENTAL VIEWS. *Pac. Sci.* 38(1):51-79. Jan. 1984. SFA 29(4)
[Dep. Fish., Univ. Tokyo, 1-1-1 Yayoi, Bunkyo-ku, Tokyo 113, Japan]

84-003163 Scarnecchia, D. L. TROUT AND CHAR PRODUCTION IN COLORADO'S SMALL STREAMS. *Ph.D. dissertation, Colo. State Univ.* 209p. 1983. From Diss. Abstr. Int. B Sci. Eng. 45(1):64. July 1984. SFA 29(4)
Annual production of trout and char in 10 small northern Colorado streams (elevation 2146-3139m a.s.l.) ranged from 1.5g/m $^2$ to 18.4g/m $^2$ in 1979 and 1980. Ratios of production to average biomass ranged from 0.23 to 0.95. Fish production in the ten streams was inversely related to elevation ($p < 0.01$) and directly related to substrate diversity ($p < 0.01$), conductivity ($p < 0.05$), hardness ($p < 0.05$), and alkalinity ($p < 0.05$). Elevation and width:depth ratio explained 60% of the variation in production; elevation and substrate explained 54% of the variation. Elevation, substrate and percent of 0 velocity stations explained 79% of the variation in production; elevation, width:depth ratio, and alkalinity explained 77% of the variation. Several combinations of four physical/chemical variables each including elevation, explained at least 82% of the variation in production. There was a strong correlation between midsummer biomass and annual production ($r = 0.86$, $p < 0.01$), as well as a strong correlation between annual production and the density of fish over 152mm (6 inches) in each stream. Several models are proposed using these relationships for predicting salmonid production in small Colorado streams.

84-003164 Serns, S. L. FIRST-SUMMER SURVIVAL, EGGS TO JUVENILES, OF SMALLMOUTH BASS IN NEBISH LAKE, WISCONSIN. *S. Afr. J. Zool.* 19(2):304-307. Apr. 1984. SFA 29(4)
[Wis. Dep. Nat. Resour., Box 440, Woodruff 54568]

84-003165 Traynor, J. J. DUAL BEAM MEASUREMENT OF FISH TARGET STRENGTH AND RESULTS OF AN ECHO INTEGRATION SURVEY OF THE EASTERN BERING SEA WALLEYE POLLOCK (*THERAGRA CHALCOGRAMMA*). *Ph.D. dissertation, Univ. Wash.* 171p. 1984. From Diss. Abstr. Int. B Sci. Eng. 45(2):485. Aug. 1984. SFA 29(4)

84-003166 Waring, G. T. AGE, GROWTH, AND MORTALITY OF THE LITTLE SKATE OFF THE NORTHEAST COAST OF THE UNITED STATES. *Trans. Am. Fish. Soc.* 113(3):314-321. May 1984. SFA 29(4)
[NMFS, Woods Hole Lab., Woods Hole, MA 02543]

84-003167 Watson, D. J. and E. K. Balon. STRUCTURE AND PRODUCTION OF FISH COMMUNITIES IN TROPICAL RAIN FOREST STREAMS OF NORTHERN BORNEO. *Can. J. Zool.* 62(5):927-940. May 1984. In English with French summ. SFA 29(4)
[E.K. Balon: Dep. Zool., Univ. Guelph, Guelph, ON N1G 2W1, Canada] Tropical fish communities are often assumed to be more productive than temperate communities. To test this belief, fishes from tributaries of the tropical rain forest Baram River, Sarawak, Malaysia were quantitatively collected with a piscicide and production was calculated by the Ricker algebraic method. Temperature was not considered a major factor influencing production among different climatic regions since the average production in the Baram (76.7kg X ha$^{-1}$ X year$^{-1}$) was less than in temperate Grand

## POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

84-003167 CONTINUED River, Ontario (279.4kg X $ha^{-1}$ X $year^{-1}$) and Nida River, Poland (121.0kg X $ha^{-1}$ X $year^{-1}$). Analysis of physical habitat characteristics, community structure variables, and production estimates from Baram streams indicated production was controlled mainly by nutrient limitations ($P < 0.01$) while close species packing maximized production by efficiently utilizing the limited resources available. In highly competitive and diverse communities, Baram fishes have probably developed specializations which make them particularly vulnerable to environmental perturbations or overexploitation. An estimated fish catch of 14.2 - 19.6kg X $ha^{-1}$ X $year^{-1}$ by Baram subsistence fishermen was already within the estimated range for maximum sustainable yield (7.9 - 20.9kg X $ha^{-1}$ X $year^{-1}$). Therefore, it is recommended that research on community ecology should precede expansion of artisanal fisheries.

84-003168 Wilcock, J. A. ORIGINS OF CHINOOK SALMON (*ONCORHYNCHUS TSCHAWYTSCHA* WALBAUM) IN THE YUKON RIVER FISHERIES, 1983. *Alaska Dep. Fish Game Inf. Leafl.* No. 243. iv+30p. Oct. 1984. SFA 29(4)
[Alaska Dep. Fish Game, Div. Commer. Fish., 333 Raspberry Rd., Anchorage 99502]

## SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC.

84-003169 Aida, K.; K. Sakai; M. Nomura; S. W. Lou; I. Hanyu; M. Tanaka; S. Tazaki and H. Ohto. REPRODUCTIVE ACTIVITY OF A TWICE-ANNUALLY SPAWNING STRAIN OF RAINBOW TROUT. *Bull. Jpn. Soc. Sci. Fish.* 50(7):1165-1172. July 1984. SFA 29(4)
[Dep. Fish., Fac. Agric., Univ. Tokyo, Bunkyo, Tokyo 113, Japan]

84-003170 Carl, L. M. CHINOOK SALMON (*ONCORHYNCHUS TSHAWYTSCHA*) DENSITY, GROWTH, MORTALITY, AND MOVEMENT IN TWO LAKE MICHIGAN TRIBUTARIES. *Can. J. Zool.* 62(1):65-71. Jan. 1984. In English with French summ. SFA 29(4)
[Fish. Br., Alberta Energy Nat. Resour., Main Floor, North Tower, Petroleum Plaza, 9945 108th St., Edmonton, AB T5K 2G6, Canada]

84-003171 Fagade, S. O.; A. A. Adebisi and A. N. Atanda. THE BREEDING CYCLE OF *SAROTHERODON GALILAEUS* IN THE IITA LAKE, IBADAN, NIGERIA. *Arch. Hydrobiol.* 100(4):493-500. 1984. In English with German summ. SFA 29(4)
[Dep. Zool., Univ. Ibadan, Ibadan, Nigeria] The breeding cycle of *Sarotherodon galilaeus* was investigated for specimens collected in a small lake at the International Institute for Tropical Agriculture (IITA), Ibadan, Nigeria. The size at maturity was established as 13.4 cm for the females while that for the male was at 16.7 cm. It is shown that the sexes were dominated by females with a ratio of 1 female to 0.60 male. The gonadal-somatic index (G.S.I.) was higher in the females than in the males. Females with mature ovaries were caught throughout the year but males with running testes were encountered only during the spawning season. Two periods of peak spawning were established for the species. These are October to November and May to June/July. The fecundity of the females was estimated

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

84-003171 CONTINUED and its relationships to body length and body weight are described. The mode of nest construction was observed and described for specimens kept in aquaria.

84-003172 Farr, J. A. PREMATING BEHAVIOR IN THE SUBGENUS *LIMIA* (PISCES: POECILIIDAE): SEXUAL SELECTION AND THE EVOLUTION OF COURTSHIP. *J. Comp. Ethol.* 65(2):152-165. June 1984. SFA 29(4)
[Dep. Biol. Sci., Fla. State Univ., Tallahassee 32306]

84-003173 Gaigher, I. G. REPRODUCTION OF *LABEO UMBRATUS* (PISCES, CYPRINIDAE) IN WURAS DAM, A SHALLOW, TURBID IMPOUNDMENT. *S. Afr. J. Zool.* 19(2):105-108. 1984. SFA 29(4)
[Inst. Environ. Sci., Univ. Orange Free State, Bloemfontein, 9301 South Africa] Female *Labeo umbratus* reach sexual maturity at a larger size than males and dominate the population in fish over 450 mm in length. The gonads are large (up to 20% of total body mass) and they have a high fecundity which increases linearly with an increase in body mass. Successful spawning is dependent on suitable floods during the spawning season which extends from November to March or April. Spawning apparently occurred in the impoundment. All females did not spawn simultaneously and evidence suggests that individuals might spawn more than once during a particular season.

84-003174 Greeley, M. S., Jr. ANNUAL AND SEMILUNAR REPRODUCTIVE CYCLES OF CYPRINODONTIDS, WITH EMPHASIS ON *FUNDULUS GRANDIS*. *Ph.D. dissertation, Univ. Ala. (Birmingham)* 157p. 1983. From Diss. Abstr. Int. B Sci. Eng. 45(3):752. Sept. 1984. SFA 29(4)

84-003175 Greeley, M. S., Jr. SPAWNING BY *FUNDULUS PULVEREUS* AND *ADINIA XENICA* (CYPRINODONTIDAE) ALONG THE ALABAMA GULF COAST IS ASSOCIATED WITH THE SEMILUNAR TIDAL CYCLES. *Copeia* 1984(3):797-800. 1 Aug. 1984. SFA 29(4)
[C.V. Whitney Lab., Univ. Fla., Rt. 1, Box 121, St. Augustine 32086]

84-003176 Itzkowitz, M. PARENTAL DIVISION OF LABOR IN A MONOGAMOUS FISH. *Behaviour* 89(3-4):251-260. June 1984. SFA 29(4)
[Biol. Dep., Lehigh Univ., Bethlehem, PA 18015]

84-003177 Kwain, W. and S. J. Kerr. RETURN OF 1-YEAR-OLD PINK SALMON IN MICHIPICOTEN RIVER, EASTERN LAKE SUPERIOR. *N. Am. J. Fish. Manage.* 4(3):335-337. 1984. SFA 29(4)
[Ontario Minist. Nat. Resour., P.O. Box 130, Sault Ste. Marie, ON P6A 5L5, Canada]

84-003178 Lasiak, T. THE REPRODUCTIVE BIOLOGY OF THE MOONY, *MONODACTYLUS FALCIFORMIS*, IN ALGOA BAY. *S. Afr. J. Zool.* 19(3):250-252. July 1984. In English with Afrikaans summ. SFA 29(4)
[Dep. Zool., Univ. Transkei, P.B. X5092, Umtata, Transkei, South Africa]

84-003179 Lichatowich, T.; S. Al-Thobaity; M. Arada and F. Bukhari. THE SPAWNING CYCLE, FRY APPEARANCE AND MASS COLLECTION TECHNIQUES FOR FRY OF *SIGANUS RIVULATUS* IN THE RED SEA. *Aquaculture* 40(3):269-271. 1 Aug.

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

84-003179 CONTINUED 1984. SFA 29(4)
[Oreg. Dep. Fish Wildl., 303 Extension Hall, Oreg. State Univ., Corvallis 97331] Data on the G.S.I. of adults and appearance of fry indicated a regular lunar spawning cycle of *S. rivulatus* within a seasonal breeding period. A mass collection technique yielding 5000-7000 fry per day was developed.

84-003180 Michael, J. H., Jr. ADDITIONAL NOTES ON THE REPEAT SPAWNING BY PACIFIC LAMPREY. *Calif. Fish Game* 70(3):186-188. July 1984. SFA 29(4)
[Wash. Dep. Fish., Room 115 Gen. Admin. Bldg., Olympia 98504]

84-003181 Mueller, G. A. SPAWNING BY *RHINICHTHYS OSCULUS* (CYPRINIDAE), IN THE SAN FRANCISCO RIVER, NEW MEXICO. *Southwest. Nat.* 29(3):354-356. 28 Aug. 1984. SFA 29(4)
[Environ. Sci. Br., Bur. Reclam., Boulder City, NV 89005]

84-003182 Reebs, S. G.; F. G. Whoriskey and G. J. Fitzgerald. DIEL PATTERNS OF FANNING ACTIVITY, EGG RESPIRATION, AND THE NOCTURNAL BEHAVIOR OF MALE THREE-SPINED STICKLEBACKS, *GASTEROSTEUS ACULEATUS* L. (F. *TRACHURUS*). *Can. J. Zool.* 62(3):329-334. Mar. 1984. In English with French summ. SFA 29(4)
[Dep. Zool., Univ. Alberta, Edmonton, AB T6G 2E9, Canada]

84-003183 Robertson, D. R. SOCIAL AND MATING SYSTEMS AND SEX CHANGE IN WRASSES AND PARROT FISHES. *Natl. Geogr. Soc. Res. Rep.* 16:561-563. 1984. SFA 29(4)
[Smithsonian Trop. Res. Inst., Balboa, Panama]

84-003184 Rowland, W. J. THE RELATIONSHIPS AMONG NUPTIAL COLORATION, AGGRESSION, AND COURTSHIP OF MALE THREE-SPINED STICKLEBACKS, *GASTEROSTEUS ACULEATUS*. *Can. J. Zool.* 62(6):999-1004. June 1984. In English with French summ. SFA 29(4)
[Dep. Biol., Indiana Univ., Bloomington, IN 47405]

84-003185 Sinclair, M. and M. J. Tremblay. TIMING OF SPAWNING OF ATLANTIC HERRING (*CLUPEA HARENGUS HARENGUS*) POPULATIONS AND THE MATCH-MISMATCH THEORY. *Can. J. Fish. Aquatic Sci.* 41(7):1055-1065. July 1984. In English with French summ. SFA 29(4)
[Halifax Fish. Res. Lab., Dep. Fish. Oceans, Scotia-Fundy Reg., Halifax, NS B3J 2S7, Canada]

84-003186 Solomon, G.; K. Matsushita; M. Shimizu and Y. Nose. THE REPRODUDTION AND CONDITION FACTOR OF ROSE BITTERLING IN SHIN TONE RIVER. *Bull. Jpn. Soc. Sci. Fish.* 50(7):1095-1103. July 1984. SFA 29(4)
[Dep. Fish., Fac. Agric., Univ. Tokyo, Bunkyo, Tokyo 113, Japan] The spawning season of rose bitterling *Rhodeus ocellatus ocellatus* was confirmed to be from April to September with a peak between April and June. Most females mature at 24 mm SL. There are more females than males in almost all the total monthly samples. Average counts of eggs in ovary to be shed in size groups 20-30 mm, 30-40 mm, and greater than 40 mm were 17-27, 26-40, and 34-69 respectively. The potential annual mean fecundity was estimated as about 700 eggs in 1981. Fish of the same length weighed more in summer than in winter. Condition factor also showed higher values in summer. Seasonal

## SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

84-003186 CONTINUED fattening cycle was observed between February and December in 1981. Unlike many temperate fish species where fattening cycle has an inverse relationship with gonadal cycle, the body lipid content of this fish, after an initial increase before the start of spawning, stays high throughout the spawning season and drops low at the end of the spawning season. Young, small fish were found to have little lipid reserve at the start of winter while larger fish increasingly recovered their lipid reserve soon after the end of spawning. The smaller fish are assumed to be in a less advantageous situation to pass the winter.

84-003187 Thresher, R. E. REPRODUCTION IN REEF FISHES. *Trop. Fish Hobbyist* 33(3):44-53. Nov. 1984. SFA 29(4)

84-003188 Thresher, R. E. REPRODUCTION IN REEF FISHES. PART 1. *Trop. Fish Hobbyist* 33(2):69-77. Oct. 1984. SFA 29(4)

84-003189 Toel, R. SPAWNING THE NUDIBRANCH *TRIDACHIA CRISPATA*. *Trop. Fish Hobbyist* 33(2):48-53. Oct. 1984. SFA 29(4)

84-003190 Trent, L.; R. O. Williams; R. G. Taylor; C. H. Saloman and C. H. Manooch III. SIZE, SEX RATIO, AND RECRUITMENT IN VARIOUS FISHERIES OF KING MACKEREL, *SCOMBEROMORUS CAVALLA*, IN THE SOUTHEASTERN UNITED STATES. *NOAA Fish. Bull*. 81(4):709-721. Oct. 1983. SFA 29(4)
[NMFS, 3500 Delwood Beach Rd., Panama City, FL 32407]

84-003191 Yermakhonov, Z. and A. K. Rasulov. ANALYSIS OF SPAWNING POPULATION AND CHARACTERISTICS OF SPAWNERS OF THE "ARAL ASP", *ASPIUS ASPIUS IBLIOIDES* (CYPRINIDAE), FROM THE LOWER REACHES OF THE SYR DARYA' RIVER. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(6):39-47. 1983. SFA 29(4)
[KazNIIRKh, Aral'sk, USSR]

84-003192 Zaki, M. I. and A. Abdula. THE REPRODUCTION AND DEVELOPMENT OF *CLARIAS GARIEPINUS* (CLARIIDAE) FROM LAKE MANZALA (EGYPT). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(6):48-58. 1983. SFA 29(4)
[Oceanogr. Fish. Inst., Alexandria, Egypt]

## MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC.

84-003193 Hoey, J. J. ANALYSIS OF LONGLINE FISHING EFFORT OF APEX PREDATORS (SWORDFISH, SHARK, AND TUNA) IN THE WESTERN NORTH ATLANTIC AND GULF OF MEXICO. *Ph.D. dissertation, Univ. Rhode Island* 306p. 1984. From Diss. Abstr. Int. B Sci. Eng. 45(3):794. Sept. 1984. SFA 29(4)

84-003194 Klimley, A. P. and D. R. Nelson. DIEL MOVEMENT PATTERNS OF THE SCALLOPED HAMMERHEAD SHARK (*SPHYRNA LEWINI*) IN RELATION TO EL BAJO ESPIRITU SANTO: A REFUGING CENTRAL-POSITION SOCIAL SYSTEM. *Behav. Ecol.*

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC. (CONTINUED)

84-003194 CONTINUED *Sociobiol.* 15(1):45-54. June 1984. SFA 29(4)
[Mar. Biol. Res. Div. (A-002), Scripps Inst. Oceanogr., Univ. Calif., San Diego, La Jolla, CA 92093]

84-003195 Laurs, R. M.; P. C. Fiedler and D. R. Montgomery. ALBACORE TUNA CATCH DISTRIBUTIONS RELATIVE TO ENVIRONMENTAL FEATURES OBSERVED FROM SATELLITES. *Deep-Sea Res. A Oceanogr. Res. Pap.* 31(9):1085-1099. Sept. 1984. SFA 29(4)
[NMFS, Southwest Fish. Cent., P.O. Box 271, La Jolla, CA 92038]

84-003196 Mathews, S. B. and M. W. Barker. MOVEMENTS OF ROCKFISH (*SEBASTES*) TAGGED IN NORTHERN PUGET SOUND, WASHINGTON. *NOAA Fish. Bull.* 81(4):916-922. Oct. 1983. SFA 29(4)
[Coll. Ocean Fish. Sci., Univ. Wash., Seattle 98195]

84-003197 Mauchline, J. and J. D. M. Gordon. FEEDING AND BATHYMETRIC DISTRIBUTION OF THE GADOID AND MORID FISH OF THE ROCKALL TROUGH. *J. Mar. Biol. Assoc. U.K.* 64(3):657-665. Aug. 1984. SFA 29(4)
[Scott. Mar. Biol. Assoc., Dunstaffnage Mar. Res. Lab., P.O. Box 3, Oban, Argyll, PA34 4AD, Scotland]

84-003198 Mulford, C. J. PRELIMINARY OBSERVATIONS OF MOVEMENT, MIGRATION PATTERNS AND WATER TEMPERATURE PREFERENCES OF STRIPED BASS IN LAKE WHITNEY, TEXAS. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 6:8. 1984. Abstract only. SFA 29(4)
[Tex. Parks Wildl. Dep., Fort Worth 76114] Movement, seasonal migration patterns and seasonal water temperature preferences of 30 adult striped bass (*Morone saxatilis*), ranging in weight from 3.0 to 9.0 kg, are being determined in Lake Whitney, Texas and the Brazos River upstream. Preliminary data analyses (early November 1982 - early August 1983) showed movement, areas of concentration and water temperatures occupied varied with season. Movement in the fall ranged from 0 to 16.6 km (mean = 2.7 km), and fish congregated in middle and lower lake areas. Depths inhabited during this period ranged from 1.5 to 15.2 m (mean = 5.2 m), and occupied water temperatures ranged from 11.2 to 18.0 C (mean = 13.5 C). Winter movement ranged from 0 to 17.6 km (mean = 4.0 km), and fish again concentrated in the middle and lower lake during early winter. However, the fish began to congregate in the the river proper as winter progressed. Depths inhabited during this season ranged from 0.9 to 12.2 m (mean = 5.3 m), and water temperatures occupied ranged from 4.5 to 15.4 C (mean = 11.9 C). Movement in the spring ranged from 0 to 43.0 km (mean = 9.3 km), and concentrations of fish were again found in the river proper. However, other fish congregated in middle and lower lake areas. Selected depths during this period ranged from 1.5 to 16.0 m (mean = 6.1 m), and occupied water temperatures ranged from 11.8 to 24.8 C (mean = 20.2 C). Summer movement ranged from 0.1 to 15.0 km (mean = 4.1 km), and fish congregated only in lower lake areas. Inhabited depths ranged from 0.1 to 13.7 m (mean = 7.4 m), and fish were found in water temperatures ranging from 22.3 to 29.5 C (mean = 27.5 C). This research will continue through April 1984.

84-003199 Sloane, R. D. PRELIMINARY OBSERVATIONS OF MIGRATING ADULT FRESHWATER EELS (*ANGUILLA AUSTRALIS AUSTRALIS* RICHARDSON) IN TASMANIA. *Aust. J. Mar. Freshwater Res.* 35(4):471-476. 1984. SFA 29(4)

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC. (CONTINUED)

84-003199 CONTINUED
[Inland Fish. Comm., 127 Davey St., Hobart, Tas. 7000, Australia] The downstream migration of maturing adult short-finned eels, *A. a. australis*, was recorded at an eel trap on the Clyde River during the 1981-1982 season. 5.2 t of eels entered thr trap from November to April with 53% of the catch taken during January. Of the 190 eels examined, only a single male specimen was found. Female *A. a. australis* migrated downstream at a mean length of 94.5 cm, a mean weight of 1700 g and a mean age of 22.1 years (range 18-30 years). There was a significant positive correlation between catch and water temperature, temperatures above 12°C being associated with eel migration. The peak catch occurred during January and coincided with the highest record of mean daily water temperature (20.5°C). The migration did not appear to be influenced by moon phase, the river flow was controlled.

84-003200 Summers, G. L. TEXOMA STRIPED BASS BIOTELEMETRY. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 6:7. 1984. Abstract only. SFA 29(4)
[Okla. Dep. Wildl. Conserv., Norman 73069] Ultrasonic transmitters were surgically implanted into 20 adult, sexually mature striped bass (*Morone saxatilis*) in Texoma Reservoir. These fish were located 140 times from June 1980 through May 1981. Findings confirmed that these transmitter-equipped striped bass were found in the central pool area of Texoma during the summer and early fall. Analysis of their position revealed highest aggregation in August with dispersion occurring in November. Although the degree of aggregation for the most part did not change from June through October, the areas that they inhabited shifted during this time. Only four transmitters were still functioning by the spring of 1981.

84-003201 Swift, I. A., Jr. A MULTIVARIATE ASSESSMENT OF THE TEMPORAL AND SPATIAL DISTRIBUTION PATTERNS OF THE FISHES OF BON SECOUR BAY, ALABAMA. *M.S. thesis, Univ. South Ala.* 82p. 1983. From Masters Abstr. 22(3)219. Sept. 1984. Abstract only. SFA 29(4)

FOODS/FEEDING

84-003202 Allen, J. R. M. and R. J. Wootton. TEMPORAL PATTERNS IN DIET AND RATE OF FOOD CONSUMPTION OF THE THREE-SPINED STICKLEBACK (*GASTEROSTEUS ACULEATUS* L.) IN LLYN FRONGOCH, AN UPLAND WELSH LAKE. *Freshwater Biol.* 14(4):335-346. Aug. 1984. SFA 29(4)
[R. J. Wootton: Dep. Zool., Univ. Coll. Wales, Aberystwyth, Dyfed, Wales] Monthly and diel patterns of food consumption by the three-spined stickleback, *Gastersteus aculeatus* L., were studied in Llyn Frongoch, a small reservoir in upland mid-Wales. Copepods were particularly prominent in the diet in spring and autumn, with ephemeropteran nymphs prominant in summer. Chironomid pupae and stickleback eggs were also elements of the diet in summer, whereas algae, plant material and debris were more important in autumn and winter. Chironomid larvae and ostracods were present throughout the year, but there was some doubt as to the importance of ostracods as digestable food items. Stomach contents were heaviest in spring and late summer and lightest in late autumn and winter. Samples for the diel samples were taken four times, once in each season. These diel samples largely reflected the seasonal changes in diet noted in the monthly samples. There were few cases of a clear switch in the composition of the diet during a 24 h period. Feeding occurred during daylight, the weight of the stomach contents declined during darkness. Several methods provided estimates of the daily rate of food consumption which ranged from 3.5 mg in December

FOODS/FEEDING (CONTINUED)

84-003202 CONTINUED (4 °C), 19.0 mg in May (15 °C). These estimates and others obtained independently suggest that the annual rate of food consumption for a stickleback in Llyn Frongoch is between 2000 and 5000 mg wet weight.

84-003203 Arcuri, M. FOOD HABITS OF LARGEMOUTH BASS, *MICROPTERUS SALMOIDES* (LACEPEDE), AND SPOTTED BASS, *MICROPTERUS PUNCTULATUS* (RAFINESQUE), FROM BEECH FORK RESERVOIR, WAYNE AND CABELL COUNTIES, WEST VIRGINIA. *Proc. W. Va. Acad. Sci.* 53(1):9. 1981. Abstract only. SFA 29(4)
[Dep. Biol. Sci., Marshall Univ., Huntington, WV 25702]

84-003204 Barbosa, P. M. M. and T. Matsumura-Tundisi. CONSUMPTION OF ZOOPLANKTONIC ORGANISMS BY *ASTYANAX FASCIATUS* CUVIER, 1819 (OSTEICHTHYES, CHARACIDAE) IN LOBO (BROA) RESERVOIR, SÃO CARLOS, SP, BRAZIL. *Hydrobiologia* 113:171-181. 29 June 1984. SFA 29(4)
[Univ. Fed. São Carlos, Dep. Cienc. Biol., Lab. Limnol., Via Washington Luis, Km 235, Caixa Postal 676, 13.560 São Carols, SP Brazil]

84-003205 Berglund, T. RELATIONS BETWEEN BROWN TROUT AND BOTTOM FAUNA IN A SWEDISH POND. *Acta Univ. Upsaliensis* 648. 16p. 1982. SFA 29(4)
[Inst. Limnol., Univ. Uppsala, POB. 557, S-751 22 Uppsala, Sweden] Predator-prey relations were studied in a pond during five years; three under natural ecosystem conditions, and two with experimental changing of predator density. The ecosystem was quite dominated by three single species on each trophic level - the charophyte *Nitella opaca*, the isopod *Asellus aquaticus* L., and the brown trout, *Salmo trutta* L. The trout was checked individually regarding gut contents and growth rate. Although *Asellus* dominated, in the guts of trout, distinct intraspecific differences were observed concerning food preferences. For example, the size of the prey objects was much more affected by traditional individual preferences than by the size of the predator. Fast growth rate during winter and spring was connected with a regular intake of relatively small prey objects, abundant in the environment, and slow growth rate with irregular predation on less abundant, large prey. Increased predator density during one year did not significantly change the biomass or the production of *Asellus*, only the food intake and growth rate of the trout. Decreased density of trout, on the other hand, immensely affected as well biomass as production of *Asellus*, with even larger secondary (positive) effects during one year's renewed presence of trout. In the latter case, production values of *Asellus* were larger than any values reported previously in literature on fish food organisms. The growth rate of the trout responded strongly to these changes in density and availability of bottom fauna.

84-003206 Bitterlich, G. and E. Gnaiger. PHYTOPLANKTIVOROUS OR OMNIVOROUS FISH? DIGESTIBILITY OF ZOOPLANKTON BY SILVERCARP, *HYPOPHTHALMICHTHYS MOLITRIX* (VAL.). *Aquaculture* 40(3):261-263. 1 Aug. 1984. SFA 29(4)
[Inst. Zool., Abt. Zoophysiol., Univ. Innsbruck, Peter-Mayr-Str. 1a, A-6020 Innsbruck, Austria]

84-003207 Blaber, S. J. M. THE DIET, FOOD SELECTIVITY AND NICHE OF *RHABDOSARGUS SARBA* (TELEOSTEI: SPARIDAE) IN NATAL ESTUARIES. *S. Afr. J. Zool.* 19(3):241-246. July 1984. In English with Afrikaans summ. SFA 29(4)
[Dep. Zool., Univ. Natal, Pietermaritzburg, South Africa]

FOODS/FEEDING (CONTINUED)

84-003208 Brock, R. E. A CONTRIBUTION TO THE TROPHIC BIOLOGY OF THE BLUE MARLIN (*MAKAIRA NIGRICANS* LACÉPÈDE, 1802) IN HAWAII. *Pac. Sci.* 38(2):141-149. Apr. 1984. SFA 29(4)

[Univ. Hawaii Inst. Mar. Biol., P.O. Box 1346, Kaneohe 96744] A study of the trophic biology of 87 blue marlin caught in Hawaiian waters indicates that these opportunistic predators consume a diverse array of prey. The data suggest that the diet of blue marlin is influenced by the locality of capture. Thus, surface (troll)-caught blue marlin from near the Hawaiian Islands consume numerous larvae, postlarvae, and juveniles of inshore species, prey relatively rare in marlin taken on the high seas. Volumetrically, these inshore forms are of little consequence and probably contribute little to the energy requirements of blue marlin. As shown in other studies, small tunas are the single most important component of Hawaiian blue marlin diets.

84-003209 Carvalho, M. L. INFLUENCE OF PREDATION BY FISH AND WATER TURBIDITY ON A *DAPHNIA GESSNERI* POPULATION IN AN AMAZONIAN FLOODPLAIN LAKE, BRAZIL. *Hydrobiologia* 113:243-247. 29 June 1984. SFA 29(4)

[Dep. Zool., Mus. Paraense Emilio Goeldi, Caixa Postal, 399, 66000-Belém, Pará, Brazil]

84-003210 Chebanova, V. V. THE ROLE OF INVERTEBRATE DRIFT IN THE FEEDING OF YOUNG COHO SALMON, *ONCORHYNCHUS KISUTCH* SALMONIDAE), IN THE KARYMAYSKIY RIVER (BOL'SHAYA RIVER BASIN, WESTERN KAMCHATKA). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(6):70-78. 1983. SFA 29(4)

[Pac. Res. Inst. Sea Fish. Oceanogr., Petropavlovsk-Kamchatskiy, USSR] The seasonal dynamics of the food of underyearlings of coho salmon, *Oncorhynchus kisutch*, were analyzed and an attempt made to interpret the diurnal rhythm of their food consumption. Coho salmon underyearlings capture benthic invertebrates mainly during the time of their drift. In addition, in the summer months the fingerlings feed intensively on adult insects, in particular on chironomids, which they take from the surface of the water.

84-003211 Clarke, T. A. DIET AND MORPHOLOGICAL VARIATION IN SNIPEFISHES, PRESENTLY RECOGNIZED AS *MACRORHAMPHOSUS SCOLOPAX*, FROM SOUTHEAST AUSTRALIA: EVIDENCE FOR TWO SEXUALLY DIMORPHIC SPECIES. *Copeia* 1984(3):595-608. 1 Aug. 1984. SFA 29(4)

[Hawaii Inst. Mar. Biol., P.O. Box 1346, Kaneohe 96744]

84-003212 Cochran, P. A. SIZE-SELECTIVE ATTACK BY PARASITIC LAMPREYS: TESTS OF ALTERNATE NULL HYPOTHESES. *Bull. Ecol. Soc. Am.* 65(2):274. June 1984. Abstract only. SFA 29(4)

[Univ. Wis., Madison]

84-003213 Crowl, T. A. LARGEMOUTH BASS PREDATION ON CRAYFISH: THE EFFECTS OF PREY SIZE. *Bull. Ecol. Soc. Am.* 65(2):185. June 1984. Abstract only. SFA 29(4)

[Univ. Okla., Norman] Laboratory experiments were performed to determine encounter rates, pursuit probabilities, capture and ingestion efficiencies for largemouth bass preying on crayfish. Reactive distances were linearly dependent on prey size and were used to estimate relative encounter rates. Pursuit probabilities and capture efficiencies were independent of prey size. Ingestion efficiencies decreased with an increase in prey size. A predation

FOODS/FEEDING (CONTINUED)

84-003213 CONTINUED model incorporating the above parameters predicts that in clear water bass will prey on small and large crayfish with equal probability. This prediction was tested by field experiments conducted in three 0.04 ha ponds. Two size classes of crayfish (18-21 and 25-28 mm carapace length) were placed in the ponds 2 h prior to bass introduction. After 24 h, the ponds were drained and remaining crayfish were collected and sorted by size class. The proportions of large and small crayfish that remained agreed with the prediction generated from the model. These results differ from those obtained in previous studies on similar species.

84-003214 Dabrowski, K. R. and D. H. Jewson. THE INFLUENCE OF LIGHT ENVIRONMENT ON DEPTH OF VISUAL FEEDING BY LARVAE AND FRY OF *COREGONUS POLLAN* (THOMPSON) IN LOUGH NEAGH. *J. Fish Biol.* 25(2):173-181. Aug. 1984. SFA 29(4)
[Inst. Ichthyobiol. Fish., 10-957 Olsztyn-Kortowo, Poland] The depth limits for visual feeding by pollan larvae and fry, *Coregonus pollan*, were determined in Lough Neagh, Northern Ireland, by combining laboratory estimates of the minimum light threshold for feeding activity with field measurements of spectral, diurnal and seasonal changes in light penetration. Although feeding thresholds were lowest in the blue light (400-490 nm), the rapid attenuation of this region in the lake meant that the depth limits of feeding *in situ* were determined by response to the green region (490-595 nm). Effects of changes in irradiance and light penetration on the depth of feeding are considered during a seasonal study. Increased sensitivity, as the juvenile stages develop, may be offset by reduced light penetration due to algal growth. Over an annual period the maximum feeding depth for pollan varied between 2.6 and 4.1 m. In the juvenile stages of two other predatory species from the lake, perch, *Perca fluviatilis*, and pike, *Esox lucius*, the corresponding ranges were 1.1-1.9 m and 2.7-4.6 m respectively.

84-003215 Drenner, R. W.; S. B. Taylor; X. Lazzaro and D. Kettle. PARTICLE-GRAZING AND PLANKTON COMMUNITY IMPACT OF AN OMNIVOROUS CICHLID. *Trans. Am. Fish. Soc.* 113(3):397-402. May 1984. SFA 29(4)
[Biol. Dep., Tex. Christian Univ., Fort Worth 76129]

84-003216 Dunbrack, R. L. and L. M. Dill. THREE-DIMENSIONAL PREY REACTION FIELD OF THE JUVENILE COHO SALMON (*ONCORHYNCHUS KISUTCH*). *Can. J. Fish. Aquatic Sci.* 41(8):1176-1182. Aug. 1984. In English with French summ. SFA 29(4)
[Dep. Biol. Sci., Simōn Frazer Univ., Burnaby, BC V5A 1S6, Canada]

84-003217 Escandon, A. E. T. SEASONAL VARIATIONS IN THE DIET AND AMOUNT AND COMPOSITION OF FECES FROM THE BLACKSMITH, *CHROMIS PUNCTIPINNIS. M.S. Thesis, Calif. State Univ.* 51p. 1983. From Masters Abstr. 22(1):5. Mar. 1984. SFA 29(4)

84-003218 Frank, K. T. and W. C. Leggett. SELECTIVE EXPLOITATION OF CAPELIN (*MALLOTUS VILLOSUS*) EGGS BY WINTER FLOUNDER (*PSEUDOPLEURONECTES AMERICANUS*): CAPELIN EGG MORTALITY RATES, AND CONTRIBUTION OF EGG ENERGY TO THE ANNUAL GROWTH OF FLOUNDER. *Can. J. Fish. Aquatic Sci.* 41(9):1294-1302. Sept. 1984. In English with French summ. SFA 29(4)
[Mar. Ecol. Lab., Bedford Inst. Oceanogr., Darmouth, NS B2Y 4A2, Canada]

FOODS/FEEDING (CONTINUED)

84-003219 Galat, D. L. DIET SHIFT BY THE PLANKTIVOROUS TUI CHUB (*GILA BICOLOR PECTINIFER*) ENCLOSED IN MESOCOSMS AT ELEVATED SALINITIES. *Bull. Ecol. Soc. Am.* 65(2):241. June 1984. Abstract only. SFA 29(4)
[Univ. Nev., Reno]

84-003220 Geevarghese, C. and P. A. John. FOOD AND FEEDING HABITS OF AN ESTUARINE GOBIID FISH *OLIGOLEPIS ACUTIPENNIS* (CUV. & VAL.)(PISCES: GOBIIDAE). *Arch. Hydrobiol.* 101(3):437-451. 1984. SFA 29(4)
[Dep. Aquatic Biol. Fish., Univ., Kerala Beach P.O., Trivandrum-695 007, Kerala, India]

84-003221 Georges, J. P. and P. Gaudin. LE TUBAGE GASTRIQUE CHEZ LES POISSONS: EXPERIMENTATION CHEZ LA TRUITELLE (*SALMO TRUTTA* L.). [GASTRIC TUBING IN FISHES: EXPERIMENTATION IN JUVENILE BROWN TROUT (*SALMO TRUTTA*).] *Arch. Hydrobiol.* 101(3):453-460. 1984. In French with English summ. SFA 29(4)
[L.A. C.N.R.S. n° 367-Univ. Lyon I., 69622 Villeurbanne Cedex, France]

84-003222 Gerking, S. D. ASSIMILATION AND MAINTENANCE RATION OF AN HERBIVOUROUS FISH, *SARPA SALPA*, FEEDING ON A GREEN ALGA. *Trans. Am. Fish. Soc.* 113(3):378-387. May 1984. SFA 29(4)
[Dep. Zool., Ariz. State Univ., Tempe 85287]

84-003223 Glandt, D. LABOREXPERIMENT ZUM BEUTE-RÄUBER-VERHÄLTNIS ZWISCHEN DREISTACHELIGEN STICHLINGEN, *GASTEROSTEUS ACULEATUS* L. (TELEOSTEI), UND ERDKRÖTENLARVEN, *BUFO BUFO* (L.)(AMPHIBIA). [LABORATORY EXPERIMENT ON THE PREY-PREDATOR RELATIONSHIP BETWEEN THREE-SPINED STICKLEBACKS, *GASTEROSTEUS ACULEATUS* L. (TELEOSTEI), AND COMMON TOAD LARVAE, *BUFO BUFO* (L.)(AMPHIBIA).] *Zool. Anz.* 213(1-2):12-16. 1984. In German with English summ. SFA 29(4)
[Biol. Inst. Metelen e. V., Forschungseinrichtung Ethol. Artenschutz, Samberg 65, D-4439 Metelen/Westfalen, West Germany]

84-003224 Golani, D.; A. Ben-Tuvia and B. Galil. FEEDING HABITS OF THE SUEZ CANAL MIGRANT SQUIRRELFISH, *SARGOCENTRON RUBRUM*, IN THE MEDITERRANEAN SEA. *Isr. J. Zool.* 32(4):194-204. 1983. SFA 29(4)
[Dep. Zool., Hebrew Univ. Jerusalem, Jerusalem 91904, Israel] The squirrelfish, *Sargocentron rubrum* (Forsskål, 1775), is a successful Suez Canal immigrant common along the Mediterranean coast of Israel and caught occasionally in small quantities in commercial catch by trammel net and by hook-and-line. Monthly samples of stomach contents of this fish caught off 'Akko (Acre), Israel, from October 1979 to October 1980 were examined. Decapoda constituted the bulk of the diet, the remainder being Polychaeta, Isopoda, Mollusca and fishes. *S. rubrum* feeds intensively in summer and lightly in winter. Seasonal predominance of each taxon in the diet was measured by an alimentary coefficient calculated as a product of the frequency and weight percentages. Brachyura constituted 77.8% in summer, 94.7% in fall and winter; Anomura constituted 82.4% in spring. *Pisidia longimana*, *Portunus hastatus*, *Xantho* spp. and *Pilumnus hirtellus* were the most commonly-found prey. No preference for feeding on Suez Canal invertebrate immigrants of Red Sea origin was observed. It is concluded that *S. rubrum* inhabits rocky bottom, at depths of 10-40 m and feeds at night.

84-003225 Hanson, J. M. and S. U. Qadri. FEEDING ECOLOGY OF AGE 0 PUMPKINSEED (*LEPOMIS GIBBOSUS*) AND BLACK CRAPPIE (*POMOXIS NIGROMACULATUS*) IN THE OTTAWA RIVER. *Can. J. Zool.* 62(4):613-621. Apr.

FOODS/FEEDING (CONTINUED)

84-003225 CONTINUED 1984. In English with French summ. SFA 29(4)
[Dep. Biol., Mcgill Univ., 1205 Ave. Docteur Penfield, Montreal, PQ H3A 1B1, Canada]

84-003226 Hart, P. J. B. and B. Connellan. COST OF PREY CAPTURE, GROWTH RATE AND RATION SIZE IN PIKE, *ESOX LUCIUS* L., AS FUNCTIONS OF PREY WEIGHT. *J. Fish Biol.* 35(3):279-292. Sept. 1984. SFA 29(4)
[Dep. Zool., Univ. Leicester, Leicester, England] Prey intake, amount of time feeding, pursuit and manipulation times and growth rate were studied in the pike, *Esox lucius*, in relation to prey weight. Predator and prey were observed in tanks at 15°C and with a 14:10 h LD photoperiod. A total of 444 captures were recorded from five 1 g prey weight groups varying from 0 to 4.9 g. Ten pike were used weighing between 50 and 149 g. As prey weight increased, the number and weight of prey consumed decreased as did the time spent feeding, which became concentrated into the first trial of the day. Pursuit time did not vary with prey weight, but manipulation time and weight of prey gained per unit pursuit plus manipulation time increased with prey weight. The growth rate of pike was a positive function of ration size and a negative function of the amount of time spent capturing each gramme of prey (capture cost). Growth rate was also correlated with the mean length and weight of prey eaten. The most profitable prey, as estimated from optimal foraging theory, need only be available once every 84 min for pike to maximize their net energy gain. The data show that feeding behaviour can have a direct influence on the reproductive success of pike through its effect on growth rate.

84-003227 Hendrick, G. and K. W. Gregg. QUANTITATIVE STUDIES OF FEEDING AND PREDATOR AVOIDANCE BEHAVIOR IN TWO SPECIES OF FISH. *Bull. S.C. Acad. Sci.* 46:100. 1984. Abstract only. SFA 29(4)

84-003228 Hoin-Radkovsky, I.; H. Bleckmann and E. Schwartz. DETERMINATION OF SOURCE DISTANCE IN THE SURFACE-FEEDING FISH *PANTODON BUCHHOLZI* PANTODONTINAE. *Anim. Behav.* 32(3):840-851. Aug. 1984. SFA 29(4)
[H. Bleckman: Zool. Inst., Johan Wolfgang Goethe Univ., Siesmayerstr. 70, D-6000 Frankfurt am Main 1, West Germany]

84-003229 Horn, M. H. and M. A. Neighbors. PROTEIN AND NITROGEN ASSIMILATION AS A FACTOR IN PREDICTING THE SEASONAL MACROALGAL DIET OF THE MONKEYFACE PRICKLEBACK. *Trans. Am. Fish. Soc.* 113(3):388-396. May 1984. SFA 29(4)
[Dep. Biol. Sci., Calif. State Univ., Fullerton 92634]

84-003230 Irvine, G. V. FISH AS FARMERS: AN EXPERIMENTAL STUDY OF HERBIVORY BY A CORAL REEF DAMSELFISH. *Ph.D. dissertation, Univ. Calif. (Santa Barbara)* 192p. 1983. From Diss Abstr. Int. B Sci. Eng. 45(1):54. July 1984. SFA 29(4)

84-003231 Irvine, G. V. LIFE HISTORY AND POPULATION BIOLOGY OF TWO SPECIES OF *POLYSIPHONIA* (RHODOPHYTA) IN TERRITORIES OF A CORAL REEF DAMSELFISH: THE EFFECTS OF GRAZING. *Bull. Ecol. Soc. Am.* 65(2):77-78. June 1984. Abstract only. SFA 29(4)
[Univ. Calif., Santa Barbara]

FOODS/FEEDING (CONTINUED)

84-003232 Jenkins, G. P.; N. E. Milward and R. F. Hartwick. FOOD OF LARVAE OF SPANISH MACKERELS, GENUS *SCOMBEROMORUS* (TELEOSTEI: SCOMBRIDAE), IN SHELF WATERS OF THE GREAT BARRIER REEF. *Aust. J. Mar. Freshwater Res.* 35(4):477-482. 1984. SFA 29(4)
[Dep. Zool., Univ. Melbourne, Parkville, Vic. 3052, Australia] Larvae of *S. semifasciatus*, *S. queenslandicus*, and *S. commerson* were dissected for gut-content analysis. *S. semifasciatus* larvae feed almost exclusively on larval fish, and *S. queenslandicus* and *S. commerson* larvae feed almost exclusively on larval fish and larvaceans. *S. queenslandicus* larvae exhibit a distinct ontogenetic change in diet, with larvaceans decreasing and larval fish increasing in dietary importance with growth. The maximum size of prey consumed by *S. semifasciatus* and *S. queenslandicus* increases with growth.

84-003233 Kennelly, S. J. EXPERIMENTS ON FISH IN AN AUSTRALIAN KELP COMMUNITY. *Bull. Ecol. Soc. Am.* 65(2):77. June 1984. Abstract only. SFA 29(4)
[Univ. Sydney, Sydney, Australia]

84-003234 Kitchell, J. F. PREDATOR-PREY SYSTEMS IN LAKE MICHIGAN: EVIDENCE FROM RECENT SEDIMENTS. *Bull Ecol. Soc. Am.* 65(2):186. June 1984. Abstract only. SFA 29(4)
[Univ. Wis., Madison] Lake Michigan's pelagic community has changed dramatically due to overexploitation, invasions by exotics, intense species interactions and fisheries management practices. These resulted in local extinctions of many invertebrates and vertebrates. Their dynamics can be reconstructed through indirect evidence derived from zooplankton remains in the deep-water sediment archive. Analysis of core cuts revealed that changes in *Bosmina longirostris* morphology document shifting predation pressures within the community. Long-spined morphs, which are less susceptible to invertebrate predators such as large copepods, dominated prior to the alewife invasion. An abrupt shift to short-spined morphs occurred after alewife decimated the larger zooplankton. Since establishment of the sea lamprey control program, stocked salmon and trout have increased predation on alewife. Recently, large zooplankton have become more abundant and the remains of long-spined *Bosmina* morphs have increased in surface sediments. Paleoecological evidence offers integrated documentation of the mechanisms and magnitude of perturbation known from independent observations. It can be used to evaluate both the likelihood and rates of return to ancestral steady-state conditions in predator-prey systems.

84-003235 Kratz, K. W. and G. L. Vinyard. PREY SELECTION BY AN AQUATIC AMBUSH PREDATOR. *Bull. Ecol. Soc. Am.* 65(2):186. June 1984. Abstract only. SFA 29(4)
[Cornell Univ., Ithaca, NY]

84-003236 Kuo, C. and S. Tanaka. [FEEDING HABIT OF HOKI *MACRURONUS NOVAEZELANDIDAE* (HECTOR) IN WATERS AROUND NEW ZEALAND.] *Bull. Jpn. Soc. Sci. Fish.* 50(5):783-786. May 1984. In Japanese with English summ. SFA 29(4)
[Dep. Fish. Biol., Taiwan Fish. Res. Inst., Keelung, Taiwan, ROC] In order to elucidate the feeding habit of the species, the condition of stomach, kinds and condition of the stomach contents were examined. Hoki are omnivores, and the range of the food contents is wide, including prochordates, crustacea, molluscs and mesopelagic fishes. In these stomach contents, myctophids and small shrimps are the most abundant ones. Although scales and mud appear in the stomach frequently, it is assumed that scales are the remnants of myctophids, and mud is swallowed into stomach when small

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84-003236 CONTINUED shrimps are eaten. Change of feeding habit with growth is observed, and is considered to be connected with the finding that the larger fish inhabit in deeper areas. The diurnal feeding periodicity is not clear. This may be partly due to the fact that the time of the sampling is concentrated in 0600-1400 of the day. The feeding activity is found to be the highest in autumn. This may be a pattern of feeding behavior before the coming spawning season in winter.

84-003237 Lester, N. P. THE "FEED:FEED" DECISION: HOW GOLDFISH SOLVE THE PATCH DEPLETION PROBLEM. *Behaviour* 89(3-4):175-199. June 1984. SFA 29(4)
[Dep. Psychol., Univ. Toronto, Toronto, ON M5S 1A1, Canada]

84-003238 Lewis, S. M. THE ROLE OF HERBIVOROUS FISHES IN STRUCTURING TROPICAL REEF COMMUNITIES. *Bull. Ecol. Soc. Am.* 65(2):77. June 1984. Abstract only. SFA 29(4)
[Duke Univ., Durham, NC]

84-003239 Luecke, C. *CHAOBORUS* AS PREDATOR AND PREY: THE LINK BETWEEN FISH PREDATION AND ZOOPLANKTON COMMUNITY STRUCTURE. *Bull. Ecol. Soc. Am.* 65(2):187. June 1984. Abstract only. SFA 29(4)
[Univ. Wash., Seattle]

84-003240 Lyons, J. WALLEYE PREDATION, YELLOW PERCH ABUNDANCE, AND THE POPULATION STRUCTURE OF LITTORAL-ZONE FISHES IN A SMALL WISCONSIN LAKE. *Bull. Ecol. Soc. Am.* 65(2):187. June 1984. Abstract only. SFA 29(4)
[Univ. Wis., Madison] I investigated the effects of walleye (*Stizostedion vitreum*) predation on the abundance and mortality of littoral-zone fishes in a Wisconsin lake. In 1982 young-of-the-year (YOY) yellow perch (*Perca flavescens*) were scarce and walleye fed on minnows and darters. Precise estimates of prey abundance could not be achieved, but it appeared that all of the observed adult mortality in these species could be accounted for by walleye consumption. In 1983 YOY yellow perch were abundant and dominated the diet of walleye. Consumption of minnows and darters was minor. As a result the instantaneous mortality rate of adult darters was lower in 1983 than in 1982, while YOY abundance was higher. However, minnow adult instantaneous mortality rates and YOY abundances were similar in 1982 and 1983. This suggests that in this lake, minnow population structure is less influenced by changes in walleye predation intensity than that of darters.

84-003241 Manooch, C. S. III and D. L. Mason. COMPARATIVE FOOD STUDIES OF YELLOWFIN TUNA, *THUNNUS ALBACARES*, AND BLACKFIN TUNA, *THUNNUS ATLANTICUS* (PISCES: SCOMBRIDAE) FROM THE SOUTHEASTERN AND GULF COASTS OF THE UNITED STATES. *Brimleyana* No. 9. p. 33-52. June 1983. SFA 29(4)
[NMFS, Beaufort Lab., Beaufort, NC 28516-9722]

84-003242 Marais, J. F. K. FEEDING ECOLOGY OF MAJOR CARNIVOROUS FISH FROM FOUR EASTERN CAPE ESTUARIES. *S. Afr. J. Zool.* 19(3):210-223. July 1984. In English with Afrikaans summ. SFA 29(4)
[Dep. Zool., Univ. Port Elizabeth, South Africa]

84-003243 McBride, S. I. and D. Tarter. FOODS AND FEEDING BEHAVIOR OF SAUGER, *STIZOSTEDION CANADENSE* (SMITH) (PISCES: PERCIDAE), FROM GALLIPOLIS LOCKS AND DAM, OHIO RIVER. *Brimleyana* No. 9. p. 123-134. June

FOODS/FEEDING (CONTINUED)

84-003243 CONTINUED 1983. SFA 29(4)

[Dep. Biol. Sci., Marshall Univ., Huntington, WV 25701] The food habits of 151 sauger, *Stizostedion canadense* (Smith), from the Ohio River at Gallipolis Locks and Dam, were studied from March 1981 through April 1982. Seventy percent of the stomachs contained food, which was analyzed for identification. Fishes were the primary food, both by weight (99.7%) and frequency of occurrence (100%). Emerald shiners, *Notropis atherinoides* Rafinesque, and gizzard shad, *Dorosoma cepedianum* (Lesueur), comprised 96% of all identifiable items. Emerald shiners were numerically and by weight the most important item; they occurred in 49% of stomachs that contained food, and made up 32% of food biomass. Terrestrial and aquatic invertebrates were of minor dietary importance. Seasonal variation in sauger foods was minimal. Size had no influence on the kind of food contained in the stomachs of adult sauger. Sauger appeared to feed most intensively in the fall. Regression analysis showed a significant negative correlation (r=-0.87) between sauger caught by anglers and water temperature.

84-003244 Mittelbach, G. G. FORAGING SPECIALIZATION, ENERGETIC GAIN, AND THE RELATIVE ABUNDANCE OF SUNFISHES. *Bull. Ecol. Soc. Am.* 65(2):186. June 1984. Abstract only. SFA 29(4)

[Ohio State Univ., Columbus] Few studies have attempted to quantitatively relate the relative abundances of species to their resource use and to the availability of their preferred resources. I have previously documented pronounced differences in resource use by two species of sunfish (*Lepomis macrochirus* and *L. gibbosus*). In small Michigan lakes *L. macrochirus* feeds predominantly on large zooplankton (*Daphnia*) and *L. gibbosus* feeds primarily on snails. These species have also been shown to differ in their relative abundance in a series of natural lakes. Here I utilize optimal diet models developed for each species feeding on its preferred resource to translate measures of resource abundance (prey size and number) in four Michigan lakes into the average energetic return available to each fish species in each lake. Estimates of energetic gains available to each species are then compared with the relative abundances of the fish in each lake to test the hypothesis that species abundances are determined by the energy derived from their preferred resources.

84-003245 Muller, M. and J. W. M. Osse. HYDRODYNAMICS OF SUCTION FEEDING IN FISH. *Trans. Zool. Soc. Lond.* 37(2):51-135. May 1984. SFA 29(4)

[Dep. Exp. Anim. Morphol. Cell Biol., Agric. Univ., Zodiac, Marijkeweg 40, 6709 PG Waginingen, Netherlands]

84-003246 Nair, J. R. and N. B. Nair. FOOD AND FEEDING HABITS OF THE TROPICAL GLASSY PERCHLET, *CHANDA (=AMBASSIS) COMMERSONII* (CUV. & VAL.) (PERCIFORMES: CENTROPOMIDAE). *Zool. Anz.* 213(1-2):89-105. 1984. SFA 29(4)

[Dep. Aquatic Biol. Fish., The Aquarium, Trivandrum-695007, Kerala, India]

84-003247 Nester, R. T. and T. P. Poe. PREDATION ON LAKE WHITEFISH EGGS BY LONGNOSE SUCKERS. *J. Great Lakes Res.* 10(3):327-328. 1984. SFA 29(4)

[U.S. FWS, Great Lakes Fish. Lab., 1451 Green Rd., Ann Arbor, MI 48105]

84-003248 Newman, R. M. and T. F. Waters. SIZE-SELECTIVE PREDATION ON *GAMMARUS PSEUDOLIMNAEUS* BY TROUT AND SCULPINS. *Ecology* 65(5):1535-1545. Oct. 1984. SFA 29(4)

[Dep. Fish. Wildl., Univ. Minn., St. Paul 55108]

FOODS/FEEDING (CONTINUED)

84-003249 Paszkowski, C. A. EXPERIMENTAL STUDIES OF THE FORAGING BEHAVIOR OF THE CENTRAL MUDMINNOW (*UMBRA LIMI*) AND THE YELLOW PERCH (*PERCA FLAVESCENS*). *Ph.D. dissertation, Univ. Wis.* 206p. 1984. From Diss. Abstr. Int. B Sci. Eng. 45(2):452. Aug. 1984. SFA 29(4)

84-003250 Paszkowski, C. A. THE FORAGING BEHAVIOR OF A GENERALIST FEEDER, THE CENTRAL MUDMINNOW (*UMBRA LIMI*). *Can. J. Zool.* 62(3):457-462. Mar. 1984. In English with French summ. SFA 29(4)
[Mar. Sci. Cent., Oreg. State Univ., Newport 97365]

84-003251 Peck, D. V. FISH COMMUNITY STRUCTURE IN A GREAT PLAINS STREAM: LABORATORY INVESTIGATIONS OF FORAGING SUCCESS AND MICROHABITAT USE. *Bull. Ecol. Soc. Am.* 65(2):73. June 1984. Abstract only. SFA 29(4)
[Univ. Okla., Norman]

84-003252 Power, M. E. HABITAT QUALITY AND THE DISTRIBUTION OF ALGAE-GRAZING CATFISH IN A PANAMANIAN STREAM. *J. Anim. Ecol.* 53(2):357-374. June 1984. SFA 29(4)
[Dep. Zool., Univ. Wash., Seattle 98195]

84-003253 Power, M. E.; W. J. Matthews and A. J. Stewart. ALGAE-GRAZING FISHES AND LARGE-SCALE DISTRIBUTIONS OF ATTACHED ALGAE IN STREAMS. *Bull. Ecol. Soc. Am.* 65(2):72-73. June 1984. Abstract only. SFA 29(4)
[Univ. Okla. Biol. Stn., Kingston]

84-003254 Prikryl, I. ABUNDANCE AND BIOMASS OF SOME IMPORTANT COMPONENTS OF ZOOPLANKTON COMMUNITY AS A FUNCTION OF FISH STOCK WEIGHT IN PONDS WITH PREVALENCE OF STOCKING AND MARKETABLE CARP. *Pr. Vodnany* No. 13. p.3-20. 1984. In English with Czech summ. SFA 29(4)
[Vyzkumny ústav Rybái. Hydrobiol., 389 25 Vodnany, Czechoslovakia]

84-003255 Reice, S. R. and R. L. Edwards. EFFECTS OF FISH PREDATION IN STREAMS WITH AND WITHOUT FISH POPULATIONS. *Bull. Ecol. Soc. Am.* 65(2):185-186. June 1984. Abstract only. SFA 29(4)
[Univ. N.C., Chapel Hill] Parallel fish manipulations were conducted in 2 Northern Quebec streams. One stream has never had fish and one had indigenous fish populations. Benthic cages were filled with cobbles and colonized *in situ*. Five initial samples were taken. Then brook trout fry were added to 5 control cages. Fish took similar prey in both streams (Chironomidae and Hydracarina). However, fish took Chydoridae extensively in the fishless stream. Analysis of benthic communities shows that caging the community reduced colonization relative to the open controls. Predation by trout did reduce the population of some taxa relative to the predator exclusion treatment. The difference between populations among predation treatments was assessed in the fishless stream relative to the stream with indigenous fishes. Differences in algal production partially confounds the results. The results suggest that "naive" benthic communities respond differently to fish predation than "experienced" ones.

84-003256 Savino, J. F. and R. A. Stein. LINKING OPTIMAL FORAGING WITH BIOENERGETICS TO DETERMINE PREDATOR FORAGING SUCCESS IN VEGETATED ENVIRONMENTS. *Bull. Ecol. Soc. Am.* 65(2):186. June 1984. Abstract only.

FOODS/FEEDING (CONTINUED)

84-003256 CONTINUED SFA 29(4)
[Ohio State Univ., Columbus]

84-003257 Shchetinnikov, A. S. NUTRITION OF *ACANTHOLUMPENUS MACKAYI* (STICHAEIDAE) IN THE GULF OF TERPENIUM (SAKHALIN ISLAND). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(6):155-158. 1983. SFA 29(4)
[AtlantNIRO, Kaliningrad, USSR]

84-003258 Smale, M. J. INSHORE SMALL-MESH TRAWLING SURVEY OF THE CAPE SOUTH COAST. PART 3. THE OCCURRENCE AND FEEDING OF *ARGYROSOMUS HOLOLEPIDOTUS*, *POMATOMUS SALTATRIX* AND *MERLUCCIUS CAPENSIS*. *S. Afr. J. Zool.* 19(3):170-179. July 1984. In English with Afrikaans summ. SFA 29(4)
[Port Elizabeth Mus., Port Elizabeth, South Africa]

84-003259 Snyder, R. J. SEASONAL VARIATION IN THE DIET OF THE THREESPINE STICKLEBACK, *GASTEROSTEUS ACULEATUS*, IN CONTRA COSTA COUNTY, CALIFORNIA. *Calif. Fish Game* 70(3):167-172. July 1984. SFA 29(4)
[Dep. Zool., Univ. Calif., Davis 95616] The major food items of threespine stickleback, *Gasterosteus aculeatus*, in Contra Costa County were insects (41.8%), crustacea (27.8%), and earthworms (9.6%). The relative importance of these items changed seasonally, although chironomid larvae formed a large part of the diet throughout most of the year. The percentage of fish with empty stomachs also varied seasonally, with the largest percentage occurring in fall and winter. The existence of schools of females and nonbreeding males may account for conflicting reports concerning differences in feeding behavior between the sexes during the breeding season. These schools may also account for the apparent correlation between food shortage and an increase in nest raiding.

84-003260 Swain, D. P. and C. C. Lindsey. SELECTIVE PREDATION FOR VERTEBRAL NUMBER OF YOUNG STICKLEBACKS, *GASTEROSTEUS ACULEATUS*. *Can. J. Fish. Aquatic Sci.* 41(8):1231-1233. Aug. 1984. In English with French summ. SFA 29(4)
[Inst. Anim. Resour. Ecol., Univ. British Columbia, Vancouver, BC V6T 1W5, Canada]

84-003261 Swedberg, D. V. and J. W. Peck. FOOD OF YOUNG-OF-THE-YEAR LAKE TROUT (*SALVELINUS NAMAYCUSH*) IN PRESQUE ISLE HARBOR, LAKE SUPERIOR. *J. Great Lakes Res.* 10(3):280-285. 1984. SFA 29(4)
[U.S. FWS, Great Lakes Fish. Lab., Ashland Biol. Stn., Ashland, WI 54806] The food habits of young lake trout (*Salvelinus namaycush*) were studied by examining the digestive tracts of 293 young-of-the-year collected in Presque Isle Harbor, Lake Superior. Lake trout in the 25 to 27-mm length range started to eat food organisms before all of their yolk material was absorbed. Organisms consumed by the 25 to 27-mm young-of-the-year included Chironomidae, Copepoda (Harpacticoida, calanoida, cyclopoida), and Cladocerea (*Daphnia* spp., *Bosmina* sp., *Chydorus* sp.). Chironomid pupae and chironomid larvae accounted for 74% and 5%, respectively, of the total volume of food eaten by the young lake trout in Presque Isle Harbor. Although copepods, cladocerans, and mysids were present in many stomachs, their contribution to the total volume of food was only 15%. Some lake trout in the 32 to 54-mm length range had consumed fry of sculpin (*Cottus* spp) or rainbow smelt (*Osmerus mordax*), but the overall contribution of fish fry to the total volume of food was only 4% (frequency of occurrence, 10%).

FOODS/FEEDING (CONTINUED)

84-003261 CONTINUED The lake trout in Presque Isle Harbor fed heavily on planktonic organisms, sparingly on benthic organisms, and were opportunistic feeders that appeared to prey on whatever forage organisms were available in the shallow nearshore waters.

84-003262 Van Leeuwen, J. L. A QUANTITATIVE STUDY OF FLOW IN PREY CAPTURE BY RAINBOW TROUT, *SALMO GAIRDNERI* WITH GENERAL CONSIDERATION OF THE ACTINOPTERYGIAN FEEDING MECHANISM. *Trans. Zool. Soc. Lond.* 37(2):171-227. May 1984. SFA 29(4)
[Dep. Exp. Anim. Morphol. Cell Biol., Agric. Univ., Zodiac, Marijkeweg 40, 6709 PG Waginingen, Netherlands]

84-003263 Van Leeuwen, J. L. and M. Muller. OPTIMUM SUCKING TECHNIQUES FOR PREDATORY FISH. *Trans. Zool. Soc. Lond.* 37(2):137-169. May 1984. SFA 29(4)
[Dep. Exp. Anim. Morphol. Cell Biol., Agric. Univ., Zodiac, Marijkeweg 40, 6709 PG Waginingen, Netherlands]

84-003264 Walsh, G. and G. J. Fitzgerald. BIAIS INHÉRENTS`A L'ANALYSE DE L'ALIMENTATION DES POISSONS. CAS DE TROIS ESPÈCES D'ÉPINOCHES (GASTEROSTEIDAE). [INHERENT BIAS IN THE ANALYSIS OF FOOD OF FISH. THE CASE OF THREE SPECIES OF STICKLEBACKS (GASTEROSTEIDAE).] *Nat. Can. (Que.)* 111(2):193-202. 1984. In French with English summ. SFA 29(4)
[Dep. Biol., Univ. Laval, Sainte-Foy, PQ G1K 7P4, Canada]

84-003265 Webb, P. W. CHASE RESPONSE LATENCIES OF SOME TELEOSTEAN PISCIVORES. *Comp. Biochem. Physiol. A Comp. Physiol.* 79(1):45-48. 1984. SFA 29(4)
[Sch. Nat. Resour., Univ. Mich., Ann Arbor 48109] Chase responses were measured for five species of teleost predators; tiger musky (*Esox* sp.), rainbow trout (*Salmo gairdneri*), smallmouth bass (*Micropterus dolomieui*), largemouth bass (*M. salmoides*) and rock bass (*Ambloplites rupestris*). Most observations were made with fathead minnow (*Pimephales promelas*) prey, but largemouth bass also attacked tiger musky, largemouth bass and bluegill sunfish (*Lepomis macrochirus*) prey. Most predators chased less than 35% of escaping prey, except trout and largemouth bass which chased 76% and 60% of escaping prey respectively. Predator chase response latencies were defined as the time between the start of the prey's escape movement and the beginning of the predator's maneuver to follow the prey. These chase latencies varied from 81 to 133 msec, averaging 101 msec. Predators chased prey at low speeds, typically 15 to 40 cm $sec^{-1}$, covering distances of about 20 cm so that chases were usually terminated in less than a second. The relatively long chase response latency, with unpredictable prey maneuverability and usually proximity to cover, appear to favor prey escape in chases and may explain not only the apparent reluctance of predators to chase but also reluctance to pursue at high speed.

84-003266 Wells, R. D. S. THE FOOD OF THE GREY MULLET (*MUGIL CEPHALUS* L.) IN LAKE WAAHI AND THE WAIKATO RIVER AT HUNTLY. *N.Z. J. Mar. Freshwater Res.* 18(1):13-19. 1984. SFA 29(4)
[Aquatic Plants Sect., Minist. Agric. Fish., P.B., Hamilton, New Zealand] The diet of the grey mullet (*Mugil cephalus* L.) was studied in Lake Waahi, and the Waikato River at Huntly - 2 highly productive freshwater habitats in New Zealand. Grey mullet fed all year despite temperatures ranging from 7-26°C. Their diet was found to include a wide range of algal species, some macrophyte detritus, inorganic particles, and occasionally the

FOODS/FEEDING (CONTINUED)

84-003266 CONTINUED snail *Potamopyrgus antipodarum*. The food items selected reflected their availability in the 2 habitats. The source of these food items is discussed and the environmental effects of mullet feeding activities are considered briefly.

## AGE AND GROWTH

84-003267 Bolz, G. R. and R. G. Lough. GROWTH OF LARVAL ATLANTIC COD, *GADUS MORHUA*, AND HADDOCK, *MELANOGRAMMUS AEGLEFINUS*, ON GEORGES BANK, SPRING 1981. *NOAA Fish. Bull.* 81(4):827-836. Oct. 1983. SFA 29(4)
[NMFS, Woods Hole Lab., Woods Hole, MA 02543]

84-003268 Boxrucker, J. COMPARISON OF PRECISION OF THE OTOLITH AND SCALE METHODS FOR AGEING WHITE CRAPPIE IN OKLAHOMA. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 6:16. 1984. Abstract only. SFA 29(4)
[Okla. Fish. Res. Lab., Norman 73069] Scales and otoliths (sagittae) were taken from a sample of 137 white crappie *Pomoxis annularis* collected by fyke netting from Fort Supply Lake, November 1982. Scales and otoliths from each fish were aged independently by three experienced scale readers. None of these individuals had prior experience aging otoliths. Reproducibility of each ageing procedure was tested with a coefficient of variation (CV) and index of precision (D) for the three readers. Mean CV for the scale and otolith methods were 58.6 and 8.2, respectively; mean D were 33.8 and 4.7, respectively. Differences in back-calculated lengths at each annuli computed from the right versus left otolith were tested using a dependent *t*-test. None of the differences observed in back-calculated lengths at ages I - IV for any of the three readers were significant at $P < 0.05$. Use of the otolith method for ageing white crappie in Oklahoma is recommended over the scale method. Once field personnel become efficient at extracting otoliths, processing time in the field is only slightly greater than for taking scale samples. Since ages can be calculated from whole otoliths, no elaborate preparation procedures are required to facilitate ageing.

84-003269 Campana, S. E. COMPARISON OF AGE DETERMINATION METHODS FOR THE STARRY FLOUNDER. *Trans. Am. Fish. Soc.* 113(3):365-369. May 1984. SFA 29(4)
[Mar. Fish. Div., Bedford Inst. Oceanogr., P.O. Box 1006, Dartmouth, NS B2Y 4A2, Canada]

84-003270 Edwards, R. R. C. COMPARISONS OF GROWTH IN WEIGHT OF TEMPERATE AND TROPICAL MARINE FISH COUNTERPARTS. *Can. J. Fish. Aquatic Sci.* 41(9):1381-1384. Sept. 1984. In English with French summ. SFA 29(4)
Fish. Div., P.O. Box 4160, Darwin, N.T. 5794, Australia]

84-003271 Gibson, R. J. and T. A. Dickson. THE EFFECTS OF COMPETITION ON THE GROWTH OF JUVENILE ATLANTIC SALMON. *Nat. Can. (Que.)* 111(2):175-191. 1984. In English with French summ. SFA 29(4)
[Dep. Fish. Oceans, P.O. Box 5667, St. John's, NF A1C 5X1, Canada] In a Québec boreal river, enhanced growth of juvenile Atlantic salmon (*Salmo salar* L.) was found: (1) when stocked in previously fishless areas; (2) when stocked in an area upstream from their natural distribution, but where brook trout [*Salvelinus fontinalis* (Mitchill)] were abundant; (3) in an area of natural distribution but when brook trout were removed. In

## AGE AND GROWTH (CONTINUED)

84-003271 CONTINUED the latter area a study over several years before removal of the brook trout indicated a relationship between changes in size of the salmon to changes in population density, and an equation was derived describing this relationship. Abundant food and space probably accounted for the increased growth rates of fry and yearling parr stocked in the fishless areas. In the area previously inhabited only by brook trout, yearling salmon and probably fry were apparently able to more efficiently use fast water areas than the trout, and due to low density of the salmon, intra-specific competition was low. In the area where brook trout were removed the growth of the 2 + parr was enhanced, but not that of the 1 + parr. We concluded that in areas of rapids, generally considered the preferred juvenile salmon habitat, intra-specific competition within year classes is more severe than inter-specific competition from brook trout, but that where slow water areas predominated inter-specific competition has negative effect on juvenile salmon, especially large parr, which use deeper and slower water than the younger stages.

84-003272 Jacobs, S. E.; W. T. Noll and J. D. Rodgers. INCREASE IN GROWTH OF JUVENILE SPRING CHINOOK SALMON (*ONCORHYNCHUS TSHAWYTSCHA*) REARING IMMEDIATELY BELOW LOST CREEK DAM ON THE ROGUE RIVER. *Oreg. Dep. Fish Wildl. Fish Div. Inf. Rep.* No. 84-6. i+14p. 1984. SFA 29(4)
[Oreg. Dep. Fish Wildl., Res. Div. Sect., Corvallis 97331]

84-003273 Keast, A. and J. Eadie. GROWTH IN THE FIRST SUMMER OF LIFE: A COMPARISON OF NINE CO-OCCURRING FISH SPECIES. *Can. J. Zool.* 62(7):1242-1250. July 1984. In English with French summ. SFA 29(4)
[Dep. Biol., Queen's Univ., Kingston, ON K7L 3N6, Canada] Growth in the first summer of life was compared in nine coexisting fish species with different life history strategies. Relative to hatching size, the various species grew 6- to 10-fold in length and up to 1000-fold in weight. Growth patterns were similar among species; length increments were linear early in the summer and reached a plateau by early September. Few species grew significantly in length or weight beyond September. There were also few appreciable differences in length-weight regressions among species, and in all cases growth was isometric. Spawning date had the greatest influence on the amount of growth attained, with early spawners achieving a greater mean length and weight than late spawners. Adult size did not influence the amount of growth; large-bodied species achieved proportionately less of their adult weight and length in the first summer than did small species. However, adult size did influence the duration of the spawning period. Small-bodied species had the most protracted spawning seasons and the greatest size range of young at the end of the summer. There was no apparent relationship between diet type and growth in young fish.

84-003274 Moreau, J. and P. Reyes. ESTIMATION DES PARAMETRES DE CROISSANCE (EQUATION DE VON BERTALANFFY): APPLICATION AUX POISSONS TROPICAUX. [ESTIMATION OF GROWTH PARAMETERS (VON BERTALANFFY EQUATION): APPLICATION TO TROPICAL FISH.] *Hydrobiologia* 114(1):13-15. 10 July 1984. In French with English summ. SFA 29(4)
[Lab. Ichtyol. Appl., Ecol. Natl. Super. Agron., 145 ave. Muret, 31076 Toulouse Cédex, France]

84-003275 Oxenford, H. A. and W. Hunte. AGE AND GROWTH OF DOLPHIN, *CORYPHAENA HIPPURUS*, AS DETERMINED BY GROWTH RINGS IN OTOLITHS. *NOAA Fish. Bull.* 81(4):906-909. Oct. 1983. SFA 29(4)
[Biol. Dep., Univ. West Indies, Barbados, West Indies]

AGE AND GROWTH (CONTINUED)

84-003276 Perry, L. G. and J. A. Tranquilli. AGE AND GROWTH OF LARGEMOUTH BASS IN A THERMALLY ALTERED RESERVOIR, AS DETERMINED FROM OTOLITHS. *N. Am. J. Fish. Manage.* 4(3):321-330. 1984. SFA 29(4)
[Ill. Nat. Hist. Surv., Nat. Resour. Bldg., 607 East Peabody Dr., Champaign, IL 61820]

84-003277 Rossouw, G. J. AGE AND GROWTH OF THE SAND SHARK, *RHINOBATOS ANNULATUS*, IN ALGOA BAY, SOUTH AFRICA. *J. Fish Biol.* 25(2):213-222. Aug. 1984. SFA 29(4)
[Dep. Zool., Univ. Port Elizabeth, Port Elizabeth, South Africa] Annual rings on the vertebral centra were used to determine age in the sand shark, *Rhinobatos annulatus*. A 6% silver nitrate solution was applied to the concave surfaces of the vertebrae to clarify the rings. The monthly percentage frequency of opaque and hyaline peripheral rings were used to determine the annual nature of the rings. Both sexes can reach a maximum age of 7 years. Conventional growth curves could not be fitted and empirical curves were used to illustrate growth. Total body length at age was calculated from these curves and compared with observed data.

84-003278 Shepherd, G. and C. B. Grimes. GEOGRAPHIC AND HISTORIC VARIATIONS IN GROWTH OF WEAKFISH, *CYNOSCION REGALIS*, IN THE MIDDLE ATLANTIC BIGHT. *NOAA Fish. Bull.* 81(4):803-813. Oct. 1983. SFA 29(4)
[NMFS, Woods Hole Lab., Woods Hole, MA 02543]

84-003279 Smith, S. E. TIMING OF VERTEBRAL-BAND DEPOSITION IN TETRACYCLINE-INJECTED LEOPARD SHARKS. *S. Afr. J. Zool.* 19(2):308-313. Apr. 1984. SFA 29(4)
[NMFS, 3150 Paradise Dr., Tiburon, CA 94920]

84-003280 Tandon, K. K. and M. S. Johal. AGE AND GROWTH OF MINOR CARP, *PUNTIUS SARANA* (HAM.). *Zool. Pol.* 30(1-4):47-57. 1984. In English with Polish and Russian summ. SFA 29(4)
[Dep. Zool., Panjab Univ., Chandigarh, India 160014]

84-003281 Tsuji, S. and T. Aoyama. DAILY GROWTH INCREMENTS IN OTOLITHS OF JAPANESE ANCHOVY LARVAE *ENGRAULIS JAPONICA*. *Bull. Jpn. Soc. Sci. Fish.* 50(7):1105-1108. July 1984. SFA 29(4)
[Ocean Res. Inst., Univ. Tokyo, Minamidai, Nakano, Tokyo 164, Japan] It was verified that the daily deposition of increments in otoliths was initiated with the start of feeding in reared Japanese anchovy larvae. The range and the coefficient of variation of counts within age group were 2-5 and 6-10%, respectively and did not vary with age. The deposition rate of increment was considered to be independent with growth rate. The width of each increment was 1-2μm around the nuclear margin and increased gradually to 6-9μm, corresponding to the appearance of subdaily rings. The otolith growth was allometric with respect to the standard length. The relationship between otolith radius and standard length seemed to be linear in log-log plot. As daily increments observed in field-collected larvae were easier to count than those of laboratory-reared ones, the age determination of field-collected samples based on daily increments was expected to have satisfactory accuracy.

84-003282 Turner, S. C.; C. B. Grimes and K. W. Able. GROWTH, MORTALITY, AND AGE/SIZE STRUCTURE OF THE FISHERIES FOR TILEFISH, *LOPHOLATILUS CHAMAELONTICEPS*, IN THE MIDDLE ATLANTIC-SOUTHERN NEW ENGLAND REGION.

## AGE AND GROWTH (CONTINUED)

84-003282 CONTINUED *NOAA Fish. Bull.* 81(4):751-763. Oct. 1983. SFA 29(4)
[NMFS, Sandy Hook Lab., Highlands, NJ 07732]

84-003283 Windell, J. T. and J. T. Light. AGE AND GROWTH OF ALPINE BROOK TROUT POPULATIONS, GREEN LAKES VALLEY, COLORADO FRONT RANGE. *Bull. Ecol. Soc. Am.* 65(2):132. June 1984. Abstract only. SFA 29(4)

[Univ. Colo., Boulder] Fish populations in an unexploited alpine watershed were assessed as part of the University of Colorado Long-Term Ecological Research program. Although within the original homerange of the threatened greenback cutthroat trout (*Salmo clarki stomias*), gill netting indicated no fish in three lakes and pure populations of brook trout (*Salvelinus fontinalis*) in three other lakes. Fish in the Green Lakes Valley averaged 131 g and 245 mm. The largest fish captured weighed 301 g and was 317 mm long. Fish ranging from 240 to 280 mm dominated the populations. No fish under 80 mm were captured in two lakes, whereas no fish under 220 mm were caught in the third lake. The youngest and smallest fish (93 mm) averaged two plus years, whereas the oldest fish was 19 years. Mean ages among populations varied slightly, but averaged 9.9 years. Growth rates were not significantly different among the populations, indicating no elevation effect.

## GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

84-003284 Babaluk, J. A. and S. M. Harbicht. RANGE EXTENSION OF THE BLACKCHIN SHINER, *NOTROPIS HETERODON*, TO DAUPHIN LAKE, MANITOBA. *Can. Field-Nat.* 98(1):58. Jan.-Mar. 1984. SFA 29(4)
[Can. Dep. Fish. Oceans, Freshwater Inst., Winnipeg, MB R3T 2N6, Canada]

84-003285 Baldwin, W. J. A NOTE ON THE OCCURRENCE OF THE GOLD SPOT HERRING, *HERKLOTSICHTHYS QUADRIMACULATUS* (RÜPPELL) IN HAWAII. *Pac. Sci.* 38(2):123-126. Apr. 1984. SFA 29(4)
[Univ. Hawaii, Hawaii Inst. Mar. Biol., P.O. Box 1346, Kaneohe 96744]

84-003286 Beckley, L. E. THE ICHTHYOFAUNA OF THE SUNDAYS ESTUARY, SOUTH AFRICA, WITH PARTICULAR REFERENCE TO THE JUVENILE MARINE COMPONENT. *Estuaries* 7(3):248-258. Sept. 1984. SFA 29(4)
[Zool. Dep., Univ. Cape Town, Rondebosch 7700, South Africa]

84-003287 Beckley, L. E. SHALLOW-WATER TRAWLING OFF THE SWARTKOPS ESTUARY, ALGOA BAY. *S. Afr. J. Zool.* 19(3):248-250. July 1984. In English with Afrikaans summ. SFA 29(4)
[Zool. Dep., Univ. Cape Town, Rondebosch, 7700, South Africa]

84-003288 Branch, G. M. and J. A. Day. ECOLOGY OF SOUTHERN AFRICAN ESTUARIES: PART XIII. THE PALMIET RIVER ESTUARY IN THE SOUTH-WESTERN CAPE. *S. Afr. J. Zool.* 19(2):63-77. 1984. SFA 29(4)
[Zool. Dep., Univ. Cape Town, Rodebosch, 770, South Africa]

84-003289 Buxton, C. D.; M. J. Smale, J. H. Wallace and V. G. Cockcroft. INSHORE SMALL-MESH TRAWLING SURVEY OF THE CAPE SOUTH COAST. PART 4. CONTRIBUTIONS TO THE BIOLOGY OF SOME TELEOSTEI AND CHONDRICHTHYES. *S. Afr.*

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84-003289 CONTINUED *J. Zool.* 19(3):180-188. July 1984. In English with Afrikaans summ. SFA 29(4)
[Port Elizabeth Mus., Port Elizabeth, South Africa]

84-003290 Craig, P. C. FISH USE OF COASTAL WATERS OF THE ALASKAN BEAUFORT SEA: A REVIEW. *Trans. Am. Fish. Soc.* 113(3):265-282. May 1984. SFA 29(4)
[LGL Ecol. Res. Assoc., P.O. Box 210887, Auke Bay, AK 99821]

84-003291 Fago, D. DISTRIBUTION AND RELATIVE ABUNDANCE OF FISHES IN WISCONSIN III. RED CEDAR RIVER BASIN. *Wis. Dep. Nat. Resour. Tech. Bull.* No. 143. 69p. 1984. SFA 29(4)
[Wis. Dep. Nat. Resour., 3911 Fish Hatchery Rd., Madison 53711]

84-003292 Gibson, R. J.; J. P. Thonney and K. Hillier. AN EASTERLY EXTENSION IN THE KNOWN RANGE FOR *FUNDULUS DIAPHANUS* IN NEWFOUNDLAND. *Nat. Can. (Que.)* 111(2):213-214. 1984. In English with French summ. SFA 29(4)
[Fish. Res. Br., Dep. Fish. Oceans, P.O. Box 5667, St. John's, NF A1C 5X1, Canada]

84-003293 Graczyk, V. J.; D. S. Dennis; C. C. Garlasco; A. M. Griffiths and D. D. Hultgren. PRELIMINARY INVESTIGATIONS OF ADULT, JUVENILE, AND LARVAL FISH OF THE MONONGAHELA RIVER AND TRIBUTARY, MORGANTOWN, WEST VIRGINIA. *Proc. W. Va. Acad. Sci.* 52(2):74-84. 1980. SFA 29(4)
[Stearns-Roger Services, Inc., Environ. Sci. Div., P.O. Box 5888, Denver, CO 80217]

84-003294 Hansson, S. COMPETITION AS A FACTOR REGULATING THE GEOGRAPHICAL DISTRIBUTION OF FISH SPECIES IN A BALTIC ARCHIPELAGO: A NEUTRAL MODEL ANALYSIS. *J. Biogeogr.* 11(5):367-381. Sept. 1984. SFA 29(4)
[Askö Lab., Univ. Stockholm, S-10691 Stockholm, Sweden]

84-003295 Hardman, C. H.; J. C. Schramm and D. C. Tarter. FISHES OF TWELVEPOLE CREEK, WEST VIRGINIA. *Proc. W. Va. Acad. Sci.* 53(1):9. 1981. Abstract only. SFA 29(4)
[Dep. Biol. Sci., Marshall Univ., Huntington, WV 25701]

84-003296 Hardman, C.; M. Arcuri; K. Bledsoe; S. Lawton; J. Schramm; G. Tolley and D. Tarter. A LIMNOLOGICAL INVESTIGATION OF THE FISHES, BENTHOS AND WATER QUALITY OF THE WEST FORK OF TWELVEPOLE CREEK, MINGO AND WAYNE COUNTIES, WEST VIRGINIA. *Proc. W. Va. Acad. Sci.* 52(2):66-74. 1980. SFA 29(4)
[Dep. Biol. Sci. Marshall Univ., Huntington, WV 25701]

84-003297 Massie, F. THE OCCURENCE OF SMALLMOUTH BASS IN THE LOWER NORTH ANNA RIVER, VA. *Va. J. Sci.* 35(2):117. 1984. Abstract only. SFA 29(4)
[Va. Elec. & Power Co., Mineral, VA 23117]

84-003298 Menni, R. C.; H. L. Lopez; J. R. Casciotta and A. M. Miquelarena. ICTIOLOGIA DE AREAS SERRANAS DE CORDOBA & SAN LUIS (ARGENTINA). [ICHTHYOLOGY OF THE HIGHLANDS IN CORDOBA AND SAN LUIS (ARGENTINA).] *Biol. Acuat.* No. 5. 63p. June 1984. In Spanish with English summ. SFA 28(4)

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Excellent protection against vibriosis was provided to ayu *Plecoglossus altivelis* vaccinated by immersion with 5.32% NaCl solution containing either 0.94(wet)g/l or 9.4(wet)g/l of lyophilized cells of *Vibrio anguillarum*. The duration of protective immunity in fish was at least 113 days. A high level of protection against vibriosis was also demonstrated in fish orally vaccinated with bacterin administered at a rate of 0.4(wet)g/kg fish/day for 15 days. However, this protective immunity lasted only 50 days after the first administration of vaccine. The serum from fish which had been vaccinated by either the immersion or oral administration did not show detectable levels of agglutinating antibodies against *V. anguillarum*.

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84-003423 Scott, M. E. and D. J. Nokes. TEMPERATURE-DEPENDENT REPRODUCTION AND SURVIVAL OF *GYRODACTYLUS BULLATARUDIS* (MONOGENEA) ON GUPPIES (*POECILIA RETICULATA*). *Parasitology* 89(2):221-227. Oct. 1984. SFA 29(4)
[Inst. Parasitol., McGill Univ., Macdonald Coll., 21111 Lakeshore Rd., Ste-Anne de Bellevue, PQ H9X 1C0, Canada] Temperature-dependent survival and reproduction of *Gyrodactylus bullatarudis* Turnbull, 1956 were examined at 17, 21, 25.5, 27.5 and 30°C on isolated guppies under conditions where parasite density dependence and host responses were minimized. Parasites had the longest life-span (5.5 days) at 21°C, the highest average fecundity (1.73 offspring) at 25.5°C and the highest instantaneous per capita birth rate (0.543/parasite/day) at 27.5°C. The intrinsic rate of increase of the parasite population was maximum (0.230/parasite/day) at 27.5°C. Data obtained from this study indicate that *G. bullatarudis* are not able to survive at 30°C.

84-003424 Scott, M. E. and R. M. Anderson. THE POPULATION DYNAMICS OF *GYRODACTYLUS BULLATARUDIS* (MONOGENEA) WITHIN LABORATORY POPULATIONS OF THE FISH HOST *POECILIA RETICULATA*. *Parasitology* 89(1):159-194. Aug. 1984. SFA 29(4)
[Inst. Parasitol., McGill Univ., Macdonald Campus, 21111 Lakeshore Road, Ste-Anne de Bellevue, PQ H9X 1C0, Canada] Experiments were undertaken to

OTHER DISEASES AND PARASITES (CONTINUED)

84-003424 CONTINUED investigate the factors which influence the transmission dynamics of *Gyrodactylus bullatarudis* within populations of laboratory guppies. The parasites possess a number of biological attributes which are almost unique amongst helminth parasites of vertebrates. These include the ability to reproduce viviparously and directly on the surface of the host, the ability to survive death of the host (for a short period of time) and the ability to transfer between hosts (despite the absence of a specialized transmission stage in the parasite's life-cycle). Long-term laboratory experiments demonstrated the inability of the parasite to persist within populations of the host in the absence of the continual introduction of naive susceptible fish. With regular addition of susceptible fish, the parasite population exhibited recurrent epidemic behaviour. The magnitudes of the epidemics and the time interval between them, were dependent on the rate at which fish were added to the populations. The parasite was over-dispersed in its distribution within the experimental fish populations and was a significant cause of host mortality (in a manner related to parasite burden). The experimental results suggest that acquired resistance to infection is an important factor determining epidemic behaviour.

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[Limnol. Inst., Univ. Konstanz, D-7750 Konstanz, West Germany] A technically simple fish monitor was developed using the weakly electric fish, *Gnathonemus petersi*, as the test organism. The test system consists of a plexiglass test chamber (2 l., 27°C) with a flow-through of 4-5 times the chamber volume per hour. The spontaneous electric organ discharges (EOD) are recorded as activity signals. EODs, which have a potential of about 500 mV, last 0.3 ms and they can be converted to computer-compatible signals by a simple amplifier. The EOD-activity is analyzed by a low-cost desk-top computer. Two different modes of analysis which represent two levels of response sensitivity, are possible either alternatively or simultaneously. The toxicity response of *Gnathonemus petersi* was measured in experiments with the toxicants $Hg^{2+}$, $Cu^{2+}$, $NaAsO_2$ and $CN^-$. The sensitivity to acutely toxic concentrations was found to be as high as that of trout or minnows.

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84-003463 CONTINUED hydrocarbons by spectrofluorometry and by gas chromatography-mass spectrometry. Fluorescence emission, di-, tri-, and tetramethylbenzenes, naphthalene and its methyl- and dimethyl homologues were used to detect contamination by gas condensate. Increased fluorescence and dimethylbenzenes were detected in the livers. It appears that fish were exposed to the gas condensate but the exposure was very low and did not affect the fish. The condensate was readily accumulated by juvenile Atlantic salmon in the laboratory. The excretion half-life was of the order of days. The potential of gas well blowouts to contaminate fish is higher than anticipated previously.

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TOXICOLOGY; BIOASSAYS (CONTINUED)

84-003469 CONTINUED determined. On the basis of information obtained, the maximum permissible limit of sodium naphthenate has been fixed at 0.15 mg/liter, and this value has been accepted as standard.

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[Dep. Biol., Tulane Univ., New Orleans, LA 70118] The concentration of hydrogen ions which caused 50% mortality of bluegill in 96 h (96 h LC50) was between pH 3.5 and 3.0 for four acids; sulphuric, nitric, phosphoric and hydrochloric. Therefore, it appears that any contribution by the anions of these acids to fish toxicity is similar. This suggests that the quantity rather than the quality of acids is the primary factor in fish toxicity brought about by acid precipitation. At sublethal concentrations of acids, bluegill became hypoactive with respect to their swimming behaviour.

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[Res. Unit Fish Biol., Rand Africkaans Univ., P.O. Box 524, Johannesburg 2000, South Africa]

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84-003475 Hartman, P.; R. Faina and J. Máchová. THE EFFECT OF THE MIDSTREAM HERBICIDE ON FISHPOND ECOSYSTEM. *Pr. Vodnany* No. 13. p.21-33. 1984. In English with Czech summ. SFA 29(4)
[Stn. Ryb., OP, tr. Míru 30 A, 371 38 Ceské Budejovice, Czechoslovakia]

84-003476 Henry, M. G. and G. J. Atchison. BEHAVIORAL EFFECTS OF METHYL PARATHION ON SOCIAL GROUPS OF BLUEGILL (*LEPOMIS MACROCHIRUS*). *Environ. Toxicol. Chem.* 3(3):399-408. 1984. SFA 29(4)
[U.S. FWS, Columbia Natl. Fish. Res. Lab., Columbia, MO 65201]

84-003477 Hinton, D. E. DETECTION OF MUTAGENIC/CARCINOGENIC ALTERATION IN FISH. *U.S. Environ. Prot. Agency* EPA-600/S3-83-076. 7 p. Nov. 1983. From Monthly Cat. U.S. Gov. Publ. 84-14875. July 1984. SFA 29(4) SFA 29(4)

84-003478 Hodson, P. V.; D. G. Dixon and K. L. E. Kaiser. MEASUREMENT OF MEDIAN LETHAL DOSE AS A RAPID INDICATION OF CONTAMINANT TOXICITY TO FISH. *Environ. Toxicol. Chem.* 3(2):243-254. 1984. SFA 29(4)
[Great Lakes Fish. Res. Br., Can. Cent. Inland Waters, Burlington, ON L7R 4A6, Canada] A new method was developed to rapidly measure the toxicity of contaminants to fish over 96 h. The method is the measurement of median lethal doses by intraperitoneal injection (IP-$LD_{50}$). Contaminants are dissolved in 5% ethanol in saline or in cod-liver oil and injected at a rate of 1.0 ml per 100 g of fish. The results of parallel bioassays to measure toxicity by oral intubation (OI-$LD_{50}$) or aqueous exposure ($LC_{50}$) were closely linked to IP-$LD_{50}$ values. The coefficient of determination ($r^2$) for a linear regression between IP-$LD_{50}$ and OI-$LD_{50}$ values was 0.99. In contrast, the $r^2$ between IP-$LD_{50}$ and $LC_{50}$ values was lower (0.44) and the regression curvilinear. However, $r^2$ improved to 0.82 when $LD_{50}$ values were divided by the logarithm of the octanol-water partition coefficient (log P). Therefore, some of the differences in toxicity between chemicals may be due to interactions between their lipid (or water) solubilities and their rate of uptake by fish. The IP-$LD_{50}$ values of five chemicals varied with the carrier used; toxicity was lower for the oil carrier compared to injections with 5% ethanol in saline. The magnitude of the difference varied with the chemical tested, so that the two measures of toxicity did not appear to be related. However, the relationships again improved when IP-$LD_{50}$ (oil) was divided by log P. The measurement of IP-$LD_{50}$ values was faster, simpler and less expensive than traditional $LC_{50}$ bioassays. The use of IP-$LD_{50}$ values to screen chemicals for their relative toxicity to fish will save time and money without any real loss in the relevance of conclusions. We propose their use for research on environmental quantitative structure-activity relationships.

84-003479 Jagoe, C. H.; T. A. Haines and F. W. Kircheis. EFFECTS OF REDUCED PH ON THREE LIFE STAGES OF SUNAPEE CHAR *SALVELINUS ALPINUS*. *Bull. Environ. Contam. Toxicol.* 33(4):430-438. Oct. 1984. SFA 29(4)
[Dep. Zool., Univ. Me., Orono 04469]

84-003480 Johnston, C. E.; R. L. Saunders; E. B. Henderson; P. R. Harmon and K. Davidson. CHRONIC EFFECTS OF LOW pH ON SOME PHYSIOLOGICAL ASPECTS OF SMOLTIFICATION IN ATLANTIC SALMON (*SALMO SALAR*). *Can. Tech. Rep. Fish. Aquatic Sci.* No. 1294. III+7p. Aug. 1984. In English with French summ. SFA 29(4)
[Biol. Stn., St. Andrews, NB EOG 2X0, Canada] Atlantic salmon (*Salmo*

84-003480 CONTINUED *salar*) were chronically exposed for several months to acidified water to determine if mean pH levels of 4.7 and 4.9 prevent smoltification from proceeding normally. Physiological changes associated with smoltification developed normally when pH was above 4.9. When pH fell below 4.7, there was impairment of ionic regulatory mechanisms leading to excessive loss of electrolytes in fresh water. Failure of ionic regulation appeared to follow an inhibition of ($Mg^{++}$)-ATPase and ($Na^{+}$, $K^{+}$)-ATPase enzyme systems. Prolonged exposure to acid water allowed salmon to develop compensatory branchial mechanisms, including increased ATPase activity, that led to improved ionic regulation.

84-003481 Kikuchi, M. and M. Wakabayashi. LETHAL RESPONSE OF SOME SURFACTANTS TO MEDAKA *ORYZIAS LATIPES* WITH RELATION TO CHEMICAL STRUCTURE. *Bull. Jpn. Soc. Sci. Fish.* 50(7):1235-1240. July 1984. SFA 29(4)
[Tokyo Metro. Res. Inst. Environ. Prot., 2-7-1, Chiyoda, Tokyo 100, Japan] A direct comparison of lethal response data of various surfactants used in new domestic phosphate-free built detergent formulations was made, using medaka as a test fish. The chemical structure of surfactant conspicuously affects toxicity. Of the structural variables of homologues, lipophilic chain length and hydrophilic oxyethylene unit length showed an important influence on toxicity for many cases. Some surfactants in use as raw materials in the new domestic detergents are more toxic than the commonly used sodium linear alkylbenzenesulfonates.

84-003482 Kleiner, C. F.; R. L. Anderson and D. K. Tanner. TOXICITY OF FENITROTHION TO FATHEAD MINNOWS (*PIMEPHALES PROMELAS*) AND ALTERNATIVE EXPOSURE DURATION STUDIES WITH FENITROTHION AND ENDOSULFAN. *Arch. Environ. Contam. Toxicol.* 13(5):573-578. Sept. 1984. SFA 29(4)
[U.S. EPA, Environ. Res. Lab., 6201 Congdon Blvd., Duluth, MN 55804] The objectives of this study were to determine the toxic effects of fenitrothion to fathead minnows (*Pimephales promelas*), to investigate effects of short-term exposures of fenitrothion and endosulfan on this species, and to determine if these compounds caused delayed mortality. Fenitrothion significantly reduced survival of fathead minnows at 0.86 and 0.74 mg/L during two 14-day embryo-larvae studies. In the 30-day embryo-larvae study, growth (weight) was not adversely affected at 0.13 mg/L; however significant differences occurred at 0.30 mg/L. Growth differences were more significant than survival. A 96-hr acute value for endosulfan was 1.32 µg/L (1.13-1.54) which agrees with published values. In this study, no delayed mortality occurred.

84-003483 Kobayashi, K.; S. Kimura and Y. Oshima. [SULFATE CONJUGATION OF VARIOUS PHENOLS BY LIVER-SOLUBLE FRACTION OF GOLDFISH.] *Bull. Jpn. Soc. Sci. Fish.* 50(5):833-837. May 1984. In Japanese with English summ. SFA 29(4)
[Lab. Fish. Environ. Sci., Fac. Agric., Kyushu Univ., Fukuoka 812, Japan]

84-003484 Kozlovskaya, V. I. and F. L. Mayer, Jr. BRAIN ACETYLCHOLINESTERASE AND BACKBONE COLLAGEN IN FISH INTOXICATED WITH ORGANOPHOSPHATE PESTICIDES. *J. Great Lakes Res.* 19(3):261-266. 1984. SFA 29(4)
[USSR Acad. Sci., Inst. Biol. Inland Waters, Borok, USSR]

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84-003485 Landau, M. and J. W. Tucker, Jr. ACUTE TOXICITY OF EDB AND ALDICARB TO YOUNG OF TWO ESTUARINE FISH SPECIES. *Bull. Environ. Contam. Toxicol.* 33(2):127-132. Aug. 1984. SFA 29(4)
[Cent. Mar. Biotechnol., Harbor Br. Inst., RR 1, Box 196A, Fort Pierce, FL 33450]

84-003486 Lehtinen, K. J.; M. Notini and L. Landner. TISSUE DAMAGE AND PARASITE FREQUENCY IN FLOUNDERS, *PLATICHTYS FLESUS* (L.) CHRONICALLY EXPOSED TO BLEACHED KRAFT PULP MILL EFFLUENTS. *Ann. Zool. Fenn.* 21(1):23-28. 1984. SFA 29(4)
[Swed. Environ. Res. Inst., Baltic Sea Lab., Utövögen 5, S-371 37 Karlskron, Sweden] One-year-old flounders, *Platichtys flesus* (L.), were exposed to kraft pulp mill effluent during a two-month period in an artificial ecosystem corresponding to the littoral zone of the Baltic Sea. The fish were exposed to 1 or 2.5% concentrations (v/v) of different types of total effluents from mills producing bleached and unbleached pulp, respectively. Fish caught in the vicinity of the discharge pipe of a pulp mill were used as reference field material. Structural differences in gill and liver tissue were detected in the exposed fish. These seemed to be positively correlated with the chlorine bleaching in the process of pulp production. The reference fish were most heavily infested with a tricodinid ciliate, followed by the fish exposed to effluents from mills using oxygen and chlorine in the bleaching process.

84-003487 Lesyuk, I. I.; A. O. Kostyuk; A. A. Lemishko; S. G. Reshetilo and I. Y. Kotsymbas. EFFECT OF ANIONIC SURFACTANTS ON THE SURVIVAL OF LOACH, *MISGURNUS FOSSILIS* (COBITIDAE), AND RAINBOW TROUT, *SALMO GAIRDNERI* (SALMONIDAE), DURING EARLY ONTOGENY. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(6):104-111. 1983. SFA 29(4)
[L'vov Div., Inst. Biochem., Acad. Sci. Ukrainian SSR, USSR]

84-003488 Lima, A. R.; C. Curtis; D. E. Hammermeister; T. P. Markee; C. E. Northcott and L. T. Brooke. ACUTE AND CHRONIC TOXICITIES OF ARSENIC(III) TO FATHEAD MINNOWS, FLAGFISH, DAPHNIDS, AND AN AMPHIPOD. *Arch. Environ. Contam. Toxicol.* 13(5):595-601. Sept. 1984. SFA 29(4)
[L. T. Brooke: Cent. Lake Superior Environ. Stud., Univ. Wis., Superior 54880]

84-003489 Máchova, J. and Z. Svobodová. EVALUATION OF FOUR TYPES OF MALACHITE GREEN AS TO ACUTE TOXICITY TO FISH. *Pr. Vodnany* No. 13. p.34-40. 1984. In English with Czech summ. SFA 29(4)
[Vyzkumny ústav Rybái. Hydrobiol., 389 25 Vodnany, Czechoslovakia]

84-003490 Máchova, J. and Z. Svobodová. EVALUATION OF FOUR TYPES MALACHITE GREEN AS TO ACUTE TOXICITY TO FISH. *Pr. Vodnany* No. 13. p.41-49. 1984. In English with Russian summ. SFA 29(4)
[Vyzkumny ústav Rybái. Hydrobiol., 389 25 Vodnany, Czechoslovakia]

84-003491 Marcelle, C. and J. Thomé. RELATIVE IMPORTANCE OF DIETARY AND ENVIRONMENTAL SOURCES OF LINDANE IN FISH. *Bull. Environ. Contam. Toxicol.* 33(4):423-429. Oct. 1984. SFA 29(4)
[Rue du Mont, 24; B-4458 Fexhe-Slins, Belgium]

TOXICOLOGY; BIOASSAYS (CONTINUED)

84-003492 Mayes, M. A.; D. C. Dill; K. M. Bodner and C. G. Mendoza. TRICLOPYR TRIETHYLAMINE SALT TOXICITY TO LIFE STAGES OF THE FATHEAD MINNOW (*PIMEPHALES PROMELAS* RAFINESQUE). *Bull. Environ. Contam. Toxicol.* 33(3):339-347. Sept. 1984. SFA 29(4)
[Environ. Sci. Res., 1702 Bldg., Dow Chemical U.S.A., Midland, MI 48640]

84-003493 Medeiros, C.; R. A. Coler and E. J. Calabrese. A LABORATORY ASSESSMENT OF THE TOXICITY OF URBAN RUNOFF ON THE FATHEAD MINNOW (*PIMEPHALES PROMELAS*). *J. Environ. Sci. Health A Environ. Sci. Eng.* 19(7):847-861. 1984. SFA 29(4)
[Dep. Environ. Sci., Skinner Hall, Univ. Mass., Amherst 01003]

84-003494 Mitani, H. COMPARISON OF THE RADIOSENSITIVITY OF THREE GOLDFISH CELL LINES USING SHORT TERM ENDPOINTS. *Int. J. Radiation Biol.* 45(6):637-643. June 1984. SFA 29(4)
[Zool. Inst., Fac. Sci., Univ. Tokyo, Tokyo 113, Japan] The induction and rejoining of DNA strand breaks after γ-irradiation in three goldfish (*Carassius auratus*) cell lines with different sensitivities to the lethal effect of γ-rays has been studied by the DNA strand separation method using hydroxylapatite chromatography. The induction and rejoining of DNA strand breaks was similar in all cell lines. There was also little difference in the degree of inhibition of DNA synthesis immediately after irradiation. However, the rank orders of the durations of division delay and the radiosensitivities of the three cell lines were the same.

84-003495 Nagai, A. and Y. Fujino. [A STUDY ON THE INGESTION OF HORSERADISH PEROXIDASE INTO THE MUCOSAL EPITHELIUM CELLS IN THE GUT OF AYU FISH *PLECOGLOSSUS ALTIVELIS*.] *J. Fac. Mar. Sci. Technol. Tokai Univ.* No. 18. p.255-263. 1984. In Japanese with English summ. SFA 29(4)

84-003496 Oikari, A.; E. Ånas; G. Kruzynski and B. Holmbom. FREE AND CONJUGATED RESIN ACIDS IN THE BILE OF RAINBOW TROUT, *SALMO GAIRDNERI*. *Bull. Environ. Contam. Toxicol.* 33(2):233-240. Aug. 1984. SFA 29(4)
[Univ. Joensuu, Dep. Biol., SF-80130 Joensuu 13, Finland]

84-003497 Oikari, A.; T. Nakari and B. Holmbom. SUBLETHAL ACTIONS OF SIMULATED KRAFT PULP MILL EFFLUENTS (KME) IN *SALMO GAIRDNERI*: RESIDUES OF TOXICANTS, AND EFFECTS ON BLOOD AND LIVER. *Ann. Zool. Fenn.* 21(1):45-53. 1984. SFA 29(4)
[Univ. Joensuu, Dep. Biol., P.O. Box 111, SF-80101 Joensuu 10, Finland]

84-003498 Oronsaye, J. A. O. and A. E. Brafield. THE EFFECT OF DISSOLVED CADMIUM ON THE CHLORIDE CELLS OF THE GILLS OF THE STICKLEBACK, *GASTEROSTEUS ACULEATUS* L. *J. Fish Biol.* 25(2):253-258. Aug. 1984. SFA 29(4)
[A. E. Brafield: Dep. Biol., Queen Elizabeth Coll., Campden Hill Rd., London W8 7AH, England] The numbers of chloride cells on the gills of three-spined sticklebacks, *Gasterosteus aculeatus*, have been measured after exposure of the fish to 0.5, 1.0 and 1.5 mg $Cd^{2+}$ $dm^{-3}$ soft water (132 mg $dm^{-3}$ as $CaCO_3$) and 2, 4 and 6 mg $Cd^{2+}$ $dm^{-3}$ hard water (299 mg $dm^{-3}$). The numbers of chloride cells increased with time but later tended to decline. The significance of this finding is discussed in relation to the functions of chloride cells, one of which is presumed to be to eject absorbed heavy metals such as cadmium.

TOXICOLOGY; BIOASSAYS (CONTINUED)

84-003499 Palachek, R. M. and J. R. Tomasso. COMPARISON OF NITRITE TOXICITY TO THREE SPECIES OF WARMWATER FISHES. *Annu. Proc. Tex. Chap. Am. Fish. Soc.* 6:18. 1984. Abstract only. SFA 29(4)

[Aquatic Stn., Southwest Tex. State Univ., San Marcos 78666] Nitrites may reach toxic concentrations in aquatic environments. Inconsistent nitrite toxicity values in the literature have often been attributed to water quality differences in test water (i.e. pH, alkalinity, hardness, chloride). Median lethal concentrations (LC-50) of nitrite were determined for three species of fish under the same water quality conditions (pH 7.9, alkalinity 230 mg/liter, hardness 260 mg/liter, temperature 23 C). Toxicity varied with species; tilapia *Tilapia aurea*, fathead minnows *Pimephales promelas* and largemouth bass *Micropterus salmoides* had 96-hour LC-50 values (mean ± 1 SE) of 53 ± 7, 141 ± 9 and 460 ± 27 mg/liter, respectively. Further research with fathead minnows indicated small fish (< 0.8 g) were more tolerant to nitrite than large fish (> 0.9 g). Size as well as species should be considered when estimating acceptable nitrite concentrations.

84-003500 Peterson, R. H. INFLUENCE OF VARYING pH AND SOME INORGANIC CATIONS ON THE PERIVITELLINE POTENTIAL OF EGGS OF ATLANTIC SALMON (*SALMO SALAR*). *Can. J. Fish. Aquatic Sci.* 41(7):1066-1069. July 1984. In English with French summ. SFA 29(4)

[Biol. Stn., St. Andrews, NB E0G 2X0, Canada]

84-003501 Primor, N.; J. A. Zadunaisky; H. V. Murdaugh, Jr.; J. L. Boyer and J. N. Forrest, Jr. PARDAXIN INCREASES SOLUTE PERMEABILITY OF GILLS AND RECTAL GLAND IN THE DOGFISH SHARK (*SQUALUS ACANTHIAS*). *Comp Biochem. Physiol. C Comp. Pharmacol. Toxicol.* 78(2):483-490. 1984. SFA 29(4)

[Osborn Lab. Mar. Sci., N.Y. Aquarium, Coney Island, Brooklyn, NY 11224]

84-003502 Rackham, B. D. and D. S. Woodhead. EFFECTS OF CHRONIC γ-IRRADIATION ON THE GONADS OF ADULT *AMECA SPLENDENS* (OSTEICHTHYES: TELEOSTEI). *Int. J. Radiation Biol.* 45(6):645-656. June 1984. SFA 29(4)

[Fish. Lab., Lowestoft, Suffolk NR33 0HT, England]

84-003503 Rask, M. THE EFFECT OF LOW pH ON PERCH, *PERCA FLUVIATILIS* L. III. THE PERCH POPULATION IN A SMALL, ACIDIC, EXTREMELY HUMIC FOREST LAKE. *Ann. Zool. Fenn.* 21(1):15-22. 1984. SFA 29(4)

[Lammi Biol. Stn., Univ. Helsinki, SF 16900 Lammi, Finland] Lake Karhuhärvi, a small, extremely humic forest lake has a perch population of 200 individuals. The growth and the composition of the diet resemble those in other, less acid lakes in the same area. The reproduction of the perch failed in the springs of 1980-1982 as a result of high mortality of roe caused by low pH. The fertilization of most eggs may have been inhibited by decreased activity of the sperm cells, but even fertilized eggs showed high mortlity. In spring 1981, many adult fish died, probably due to the low pH and high aluminum concentration of the water.

84-003504 Rask, M. THE EFFECT OF LOW pH ON PERCH, *PERCA FLUVIATILIS* L. II. THE EFFECT OF ACID STRESS ON DIFFERENT DEVELOPMENT STAGES OF PERCH. *Ann. Zool Fenn.* 21(1):9-13. 1984. SFA 29(4)

[Lammi Biol. Stn., Univ. Helsinki, SF 16900 Lammi, Finland] The pH sensitivity of perch eggs, fry, young of the year, and adult fishes was studied. The eggs were most sensitive soon after fertilization and fry after hatching while the adult perch were most tolerant. The variation in pH sensitivity of eggs between single females was wide. The pH sensitivity of eggs from two perch populations showed a difference at pH 4.0. The fry

TOXICOLOGY; BIOASSAYS (CONTINUED)

84-003504 CONTINUED became acclimatised to the pH: the lower the pH at hatching, the better tolerance to low pH as fry. At a constant low pH there was a correlation between the conductivity of water and pH sensitivity of eggs.

84-003505 Richkus, W. A. CONSIDERATIONS IN THE SELECTION OF COMMERCIAL ANALYTICAL LABORATORIES. *Fisheris (Bull. Am. Fish. Soc.)* 9(5):12-15. Sept.-Oct. 1984. SFA 29(4)

The public is concerned about the direct and indirect introduction of toxic materials into the aquatic environment. As a result, many biologists must deal with the effects of unfamiliar chemical substances on biota, and many turn to commercial laboratories for analytical assistance. A case study demonstrates the problems associated with the use of such laboratories. The study goal was to determine trace metal body burdens for several groups of biota. Unidentified replicate and split samples of freeze-dried tissues were distributed to three laboratories for analysis of 11 metals. Unidentified NBS standards were also distributed. Accuracy and precision of the laboratories differed markedly. Good precision (based on split samples) was shown by only one laboratory, and most results from all three laboratories did not fall within 95% confidence limits of NBS standards. Extreme care must be exercised in selecting analytical laboratories, and quality control procedures independent of those used by the laboratories should be followed to ensure the validity of data obtained.

84-003506 Sastry, K. V. and A. A. Siddiqui. SOME HEMATOLOGICAL, BIOCHEMICAL, AND ENZYMOLOGICAL PARAMETERS OF A FRESH-WATER TELEOST FISH, *CHANNA PUNCTATUS*, EXPOSED TO SUBLETHAL CONCENTRATIONS OF QUINALPHOS. *Pestic. Biochem. Physiol.* 22(1):8-13. Aug. 1984. SFA 29(4)
[Dep. Zool., M.D. Univ., Rohtak (Haryana), India]

84-003507 Sastry, K. V. and D. R. Rao. EFFECT OF MERCURIC CHLORIDE ON SOME BIOCHEMICAL AND PHYSIOLOGICAL PARAMETERS OF THE FRESHWATER MURREL, *CHANNA PUNCTATUS*. *Environ. Res.* 34(2):343-350. Aug. 1984. SFA 29(4)
[Environ. Toxicol. Lab., Dep. Zool., DAV (PG) Coll., Muzaffarnagar-251001, India]

84-003508 Sastry, K. V. and S. Subhadra. EFFECT OF CADMIUM AND ZINC ON INTESTINAL ABSROPTION OF XYLOSE AND TRYPTOPHAN IN THE FRESH WATER TELEOST FISH, *HETEROPNEUSTES FOSSILIS*. *Chemosphere* 13(8):889-898. 1984. SFA 29(4)
[Post Grad. Dep. Zool., M.D. Univ., Rohtak (Haryana), India]

84-003509 Scarano, G.; M. G. Saroglia; R. H. Gray and E. Tibaldi. HEMATOLOGICAL RESPONSES OF SEA BASS *DICENTRARCHUS LABRAX* TO SUBLETHAL NITRITE EXPOSURES. *Trans. Am. Fish. Soc.* 113(3):360-364. May 1984. SFA 29(4)
[CNR, ISBL, Via Fraccacreta I, 71010 Lesina, Italy]

84-003510 Schoor, W. P. and M. Srivastava. POSITION-SPECIFIC INDUCTION OF BENZO(A)PYRENE METABOLISM BY 3-METHYLCHOLANTHRENE AND PHENOBARBITAL IN MULLET (*MUGIL CEPHALUS*), A MARINE FISH. *Comp. Biochem. Physiol. C Comp.*

TOXICOLOGY; BIOASSAYS (CONTINUED)

84-003510 CONTINUED *Pharmacol. Toxicol.* 78(2):391-396. 1984. SFA 29(4)
[U.S. Environ. Prot. Agency, Environ. Res. Lab., Gulf Breeze, FL 32561]

84-003511 Sebert, P.; L. Barthelemy and C. Peyraud. OXYGEN TOXICITY IN TROUT AT TWO SEASONS. *Comp. Biochem. Physiol. A Comp. Physiol.* 78(4):719-722. 1984. SFA 29(4)
[Lab. Physiol., ERA-CNRS No. 622, Fac. Med., 22, rue Camille Desmoulins, 29 279 Brest-Cédex, France]

84-003512 Segers, J. H. L.; J. H. M. Temmink; J. H. J. Van den Berg; and R. C. C. Wegman. MORPHOLOGICAL CHANGES IN THE GILL OF CARP (*CYPRINUS CARPIO* L.) EXPOSED TO ACUTELY TOXIC CONCENTRATIONS OF METHYL BROMIDE. *Water Res.* 18(11):1437-1441. 1984. SFA 29(4)
[Dep. Toxicol., Agric. Univ., De Dreijen 12, 6703 BC Wageningen, Netherlands]

84-003513 Shelton, D. W.; J. D. Hendricks; R. A. Coulombe and G. S. Bailey. EFFECT OF DOSE ON THE INHIBITION OF CARCINOGENESIS/MUTAGENESIS BY AROCLOR 1254 IN RAINBOW TROUT FED AFLATOXIN $B_1$. *J. Toxicol. Environ. Health* 13(4-6):649-657. 1984. SFA 29(4)
[J.D. Hendricks: Dep. Food Sci. Technol., Oreg. State Univ., Corvallis 97331]

84-003514 Somasundaram, B.; P. E. King and S. E. Shakley. SOME MORPHOLOGICAL EFFECTS OF ZINC UPON THE YOLK-SAC LARVAE OF *CLUPEA HARENGUS* L. *J. Fish Biol.* 25(3):333-343. Sept. 1984. SFA 29(4)
[Dep. Zool., Singleton Park, Swansea, West Glamorgan SA2 8PP, England] Some effects of low concentrations of zinc on the eggs and yolk-sac larvae of *Clupea harengus* L. are examined. Deformations of the jaw, head, optic capsules, otic capsules and vetebral column are described. With some of these deformations, induced by lower zinc concentrations, the larvae survive and continue development but others, in the higher zinc concentrations, die.

84-003515 Spry, D. J. and C. M. Wood. ACID-BASE, PLASMA ION AND BLOOD GAS CHANGES IN RAINBOW TROUT DURING SHORT TERM TOXIC ZINC EXPOSURE. *J. Comp. Physiol. B Biochem. Syst. Environ. Physiol.* 154(2):149-158. Feb. 1984. SFA 29(4)
[Dep. Biol., McMactee Univ., Hamilton, ON L8S 4K1, Canada]

84-003516 Svobodová, Z.; R. Faina; J. Máchová and J. Prausová. PERSISTENCE OF THE MIDSTREAM HERBICIDE IN POND ENVIRONMENT. *Pr. Vodnany* No. 13. p.34-40. 1984. In English with Czech summ. SFA 29(4)
[Vyzkumny ústav Rybái. Hydrobiol., 389 25 Vodnany, Czechoslovakia]

84-003517 Takimoto, Y; M. Ohshima; H. Yamada and J. Miyamoto. FATE OF FENITROTHION IN SEVERAL DEVELOPMENTAL STAGES OF THE KILLIFISH (*ORYZIAS LATIPES*). *Arch. Environ. Contam. Toxicol.* 13(5):579-587. Sept. 1984. SFA 29(4)
[Takarazuka Res. Cent., Sumitomo Chem. Co., Ltd., Takarazuka, Japan]

TOXICOLOGY; BIOASSAYS (CONTINUED)

84-003518 Thomas, P. and H. W. Wofford. EFFECTS OF METALS AND ORGANIC COMPOUNDS ON HEPATIC GLUTATHIONE, CYSTEINE, AND ACID-SOLUBLE THIOL LEVELS IN MULLET (*MUGIL CEPHALUS L.*). *Toxicol. Appl. Pharmacol.* 76(1):172-182. Oct. 1984. SFA 29(4)
[Univ. Tex., Mar. Sci. Inst., Port Aransas 78373]

84-003519 Tort, L.; M. Rosell and R. Flos. OXYGEN CONSUMPTION OF DOGFISH RECTAL GLAND AFTER *IN VITRO* AND *IN VIVO* ZINC TREATMENTS. *Mar. Pollut. Bull.* 15(7):253-255. July 1984. SFA 29(4)
[Fisiol. Anim., Fac. Cienc., Univ. Autonoma Barcelona, Bellaterra (Barcelona), Spain]

84-003520 Van Hoof, F. and J. P. Nauwelaers. DISTRIBUTION OF NICKEL IN THE ROACH (*RUTILUS RUTILUS* L.) AFTER EXPOSURE TO LETHAL AND SUBLETHAL CONCENTRATIONS. *Chemosphere* 13(9):1053-1058. 1984. SFA 29(4)
[I.V. Antwerpse Waterwerken N.V., Mechelsesteenweg 64, B-2018 Antwerp, Belgium]

84-003521 Wendelaar Bonga, S. E.; J. C. A. Van der Meij and G. Flik. PROLACTIN AND ACID STRESS IN THE TELEOST *OREOCHROMIS* (FORMERLY SAROTHERODON) *MOSSAMBICUS*. *Gen. Comp. Endocrinol.* 55(2):323-332. Aug. 1984. SFA 29(4)
[Dep. Zool, Univ. Nijmegen, Toernooiveld 25, 6525 ED Nijmegen, Netherlands]

84-003522 Woltering, D. M. THE GROWTH RESPONSE IN FISH CHRONIC AND EARLY LIFE STAGE TOXICITY TESTS: A CRITICAL REVIEW. *Aquat. Toxicol. (N. Y.)* 5(1):1-21. 1984. From Deep-Sea Res. B Oceanogr. Lit. Rev. 31(8):565. 1984. SFA 29(4)
[Environ. Safety Dep., Proctor and Gamble Co., Cincinnati, OH 54217]

84-003523 Zakharova, N. I. DEVELOPMENT OF THE GONADS OF RAINBOW TROUT, *SALMO GAIRDNERI* (SALMONIDAE), IN THE POST RADIATION PERIOD. 1. RADIATION OF LARVAE AT AN AGE OF 24 DAYS AFTER HATCHING. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 23(6):59-69. 1983. SFA 29(4)
[Lenningrad Univ., USSR] The development of gonads of rainbow trout, *Salmo gairdneri* (22-147 days after hatching), in the normal state, and after radiation at doses of 25, 350 and 1000 R at an age of 24 days, was investigated. A radiation dose of 25 R has no harmful effect while doses of 350 and 1000 R are injurious. Towards the end of the experiment (147 days) complete renewal of the qualitative composition of the sex cells is observed in irradiated fish. It is assumed that the sources of renewal of sex cells may be the gonia and also cells of the germinal epithelium which survived radiation.

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TOXICOLOGY; BIOASSAYS (CONTINUED)

84-003524 CONTINUED disturbance in the locomotory function as well as histological analysis of different sections of brain and spinal cord. It was found that the severity of pathology increases from the cerebral hemisphere to the segmental parts of brain.

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[Div. Wildl. Fish. Biol., Univ. Calif., Davis 95616] Although optimal fishery policy has been derived from different kinds of economic and biological models, the interaction of fishing policy with artificial stocking policy has not been explicitly considered. We here determine optimal size limits, fishing effort, and stocking rate for three cases of interest: (1) recruitment-limited population, pre-recruitment stocking; (2) adult biomass-limited population, post-recruitment stocking; and (3) adult biomass-limited and recruitment-limited population, post-recruitment stocking. Results show that lower size limits should be set at the size at which the current market value exceeds the total future value of an individual, both to the fishery and to reproduction. Imposition of upper size limits is rarely optimal. Stocking is advisable when the hatchery cost times the relative contribution of stocking to recruitment is less than the contribution to the value of the catch. Optimal policy ranges from infinite effort at a specific size limit with maximum stocking when the cost of stocking is zero, to lower values of size limit and effort as stocking costs increase, the amount of stocking decreases, and more natural reproduction is optimal. Thus, as hatchery costs decline (or the value of captured fish increases), optimal stocking/fishery policy varies from an unstocked fishery to a "put and take" fishery. The results are applied to the sturgeon fishery in San Francisco Bay Estuary as an example. They imply that a reduced lower size limit and greater fishing mortality together with stocking would be optimal, but that current levels are conservative. The stocking decision depends critically on the values of parameters that are currently poorly known, such as: hatchery costs, survival to the fishery and the mechanisms controlling the sturgeon population.

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As a result of an increasing demand placed on black bass fisheries statewide, the minimum length limit on black bass was changed from ten inches to twelve inches at the beginning of 1978. A five-year research project to evaluate the effect of the new limit on fish population structure, exploitation, natural mortality, survival, age and growth characteristics, and anglers creel, was initiated simultaneously. Cove rotenone, electrofishing, fish tagging, and creel surveys were employed to collect data from each of nine study sites annually. Fish population structure changes included increase in young-of-year bass numbers and increases in the biomass of intermediate-size bass after the 12-inch limit became effective. Exploitation, natural mortality, and survival rate changes displayed wide variations with no trends apparent. Growth rates slowed slightly under the new size limt. Fishing pressure increased as did the number and weight of bass harvested following an initial decrease during the first year. The overall quality of the black bass fishery in terms of larger fish harvested improved slightly while the anticipated over-exploitation of bass was reduced at some sites and increased at others following imposition of the 12-inch length limit.

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84-003573 CONTINUED
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[U.S. FWS, Natl. Fish Hatchery Dev. Cent., San Marcos, TX 78666] Coded wire tags were implanted into the snouts of fingerling (mean total length and weight, 92 mm and 10.8 g) largemouth bass *Micropterus salmoides* to evaluate tag retention. The stainless steel wire tags (1.0 x 0.25 mm) were injected into the nasal cartilage of 200 fingerlings. A control group of 280 fingerlings was handled indentically but received no tags. The two groups were mixed and stocked into 0.04-hectare earthen ponds. Random samples were taken irregularly throughout the 16-month study period. Three independent methods of tag detection were used: dissection, electronic metal detection,

MARKING AND TAGGING (CONTINUED)

84-003584 CONTINUED and x-ray. Largemouth bass fingerlings shed coded wire tags within the first 4 to 6 months, after which tag retention stabilized (58.6% after 16 months). At harvest, no significant differences were detected between tagged and untagged fingerlings for total survival, growth (length, weight, and condition) or behavior.

STOCKING AND INTRODUCTIONS

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[Idaho Coop. Fish. Res. Unit, Univ. Idaho, Moscow 83843] Steelhead trout transferred to a pond with cold water (4-10C) 8 to 12 weeks before release after being reared in 15C water, returned at higher rates than fish held in 15C water until release. Of six marked groups released in 1979 and 1980, all three groups of fish conditioned in cold water returned at higher rates than the three groups of unconditioned fish. A group of conditioned fish that averaged 227 mm in length when released, returned at twice the rate of other groups. Size and health of fish were important factors in return rates. Fish held in 15C water until release migrated seaward slightly later than conditioned fish. Steelhead trout released in the Lemhi River during January-March survived poorly because of thermal shock despite eight hours of acclimation during transport. Steelhead released in the upper end of the Lemhi River were captured at Lower Granite Dam at only one-tenth the rate of fish released 69 km further downstream near the mouth of the river. Steelhead released in the upper river may have had difficulty negotiating the 40 or more irrigation diversions when migrating down the Lemhi River.

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[Inst. Ichthyobiol. Fish., Acad. Agric. Technol., 10-957 Olsztyn-Kortowo, Bl. 37, Poland] Low survival of vendace (*Coregonus albula*) eggs incubating on natural spawning grounds (due to silting, oxygen deficits and action of predators) is discussed as one of the reasons for the great fluctuation in numbers of commercial fish. Incubation of eggs in hatcheries where the survival rate averages 60% could compensate for the great numerical

STOCKING AND INTRODUCTIONS (CONTINUED)

84-003589 CONTINUED disparity between the eggs spawned naturally and those taken for hatcheries. In the absence of the effects of mass stocking of lakes with vendace larvae, one can conclude that apparent mortality during the larval stage also determines the strength of the successive year-class. Vendace larvae are usually stocked immediately after the ice cover recedes from lakes. At this time they often face a period of cold weather when water temperature is low and food organisms are scarce. Poor environmental conditions cause slow growth of larvae. This increases the period of highest vulnerability of the larvae to predation. It is possible to accelerate the growth of larvae by synchronizing the time of stocking with the development of favourable thermal conditions and food availability in lakes. In Polish climatic conditions the first 10 days of May seem to be a suitable time for stocking lakes. A technique for delaying vendace egg hatching by cooling the hatchery water has been developed. It enables hatching of vendace to be delayed from the beginning of April until the beginning of May, thereby inducing mass hatching of larvae when lake conditions are optimal for stocking.

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[Tex. Parks Wildl. Dep., Austin 78744] Dominant zooplankton groups and water quality characteristics were compared over a 4-week study period to determine if cottonseed meal or chicken manure fertilizer yielded the best forage base for saltwater fish culture. The two fertilizers were individually applied at 568 kg/hectare to each of three 0.1-hectare unstocked brackish water fish culture ponds. Temperature and salinity of the treated ponds reflected seasonal ambient conditions and were statistically similar for both fertilizers. Dissolved oxygen levels were significantly lower in cottonseed meal treated ponds. Rotifers, *Oithona* sp. and polychaete larvae densities were not significantly different between the two fertilizers. However, *Acartia tonsa* and mixed copepod nauplii densities were significantly greater in cottonseed meal treated ponds. Based on the importance of copepods in the diet of cultured brackish water fish, cottonseed meal was considered best for zooplankton forage base establishment.

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[Okla. Dep. Wildl. Conserv., Caddo 74729] The Oklahoma Department of Wildlife Conservation introduced striped bass (*Morone saxatilis*) into Texoma Reservoir from 1965 through 1974 to create a new sport fishery and provide a biological control on abundant gizzard shad (*Dorosoma cepedianum*) and threadfin shad (*D. petenense*) populations. Natural reproduction of striped bass was verified in 1973 and has occurred each year since. In 1976 a project was initiated to study their effects on existing fish populations. During the 6-year period from 1976 to 1982, striped bass increased and became the most abundant sport species. This resulted in the creal limit being liberalized from one in 1976 to 15 in 1981. Largemouth bass (*Micropterus salmoides*) and spotted bass (*M. punctulatus*) remained relatively stable during this period, showing some increase in 1981 and 1982. Extremely low water temperatures during the winter of 1976 resulted in threadfin shad being absent from the reservoir in 1977 and 1978. Following their reintroduction in 1979 they became the most abundant species in 1980 and 1981 rotenone surveys. In 1976 the dominant length mode of gizzard shad was 254 mm. However in 1977 the length frequency of gizzard shad became bimodal with the additional mode being in the 76- to 152-mm range. In 1982 the number of small gizzard shad increased with the 102- and 127-mm size groups representing 95% of the population. The white bass (*M. chrysops*) population declined with the greatest decrease occurring in 1977 following the winterkill of threadfin shad. Crappie (*Pomoxis* spp.) populations were low all years during the study.

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## LARGE IMPOUNDMENT MANAGEMENT AND RESEARCH (CONTINUED)

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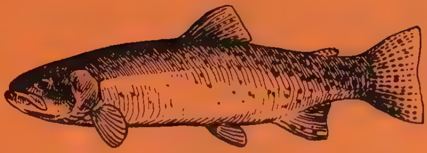

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  - Gyrodactylus
    - 84-001463
    - 84-001464
  - Gyrodactylus bullatarudis
    - 84-002461
    - 84-003423
    - 84-003424
  - Gyrodactylus fryi
    - 84-003402
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    - 84-001464
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   84-001440
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    84-000560
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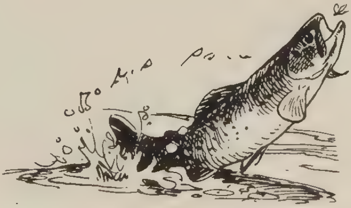

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